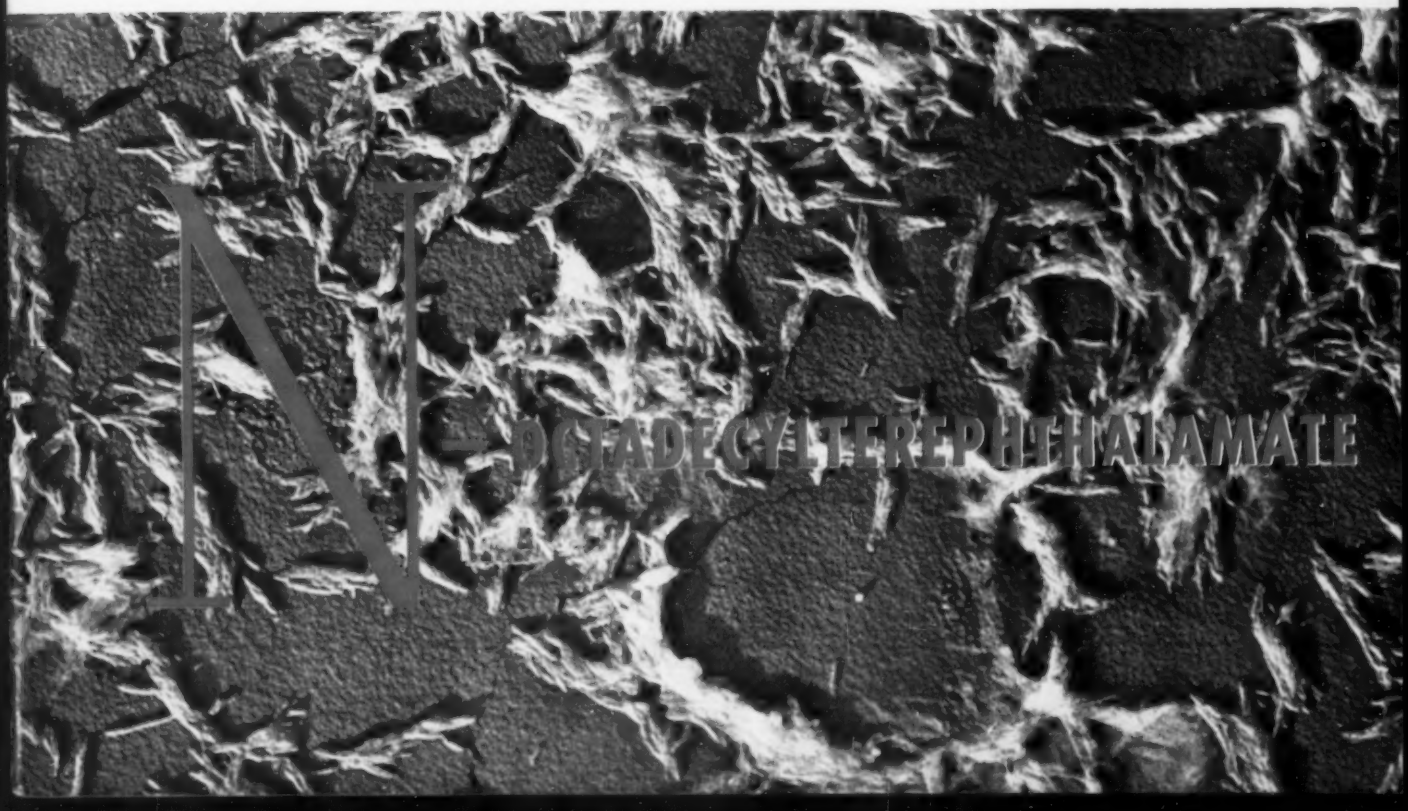
february 1957

nlgi spokesman

journal of the national lubricating grease institute



SUBSTANTIAL SAVINGS in downtime and maintenance costs have been experienced by many users of estersil greases in heavy-duty equipment.

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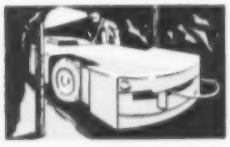
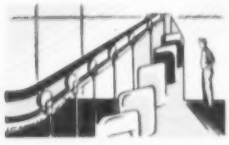


COAL MINE OPERATORS report that heavy-duty mining machinery lasts longer with reduced grease consumption and maintenance costs when lubricated with estersil greases.



IN HIGH TEMPERATURE APPLICATIONS also, estersil greases are outstanding. They have been efficiently used in enameling oven conveyor setups operating at 500°F. in 15-minute cycles.

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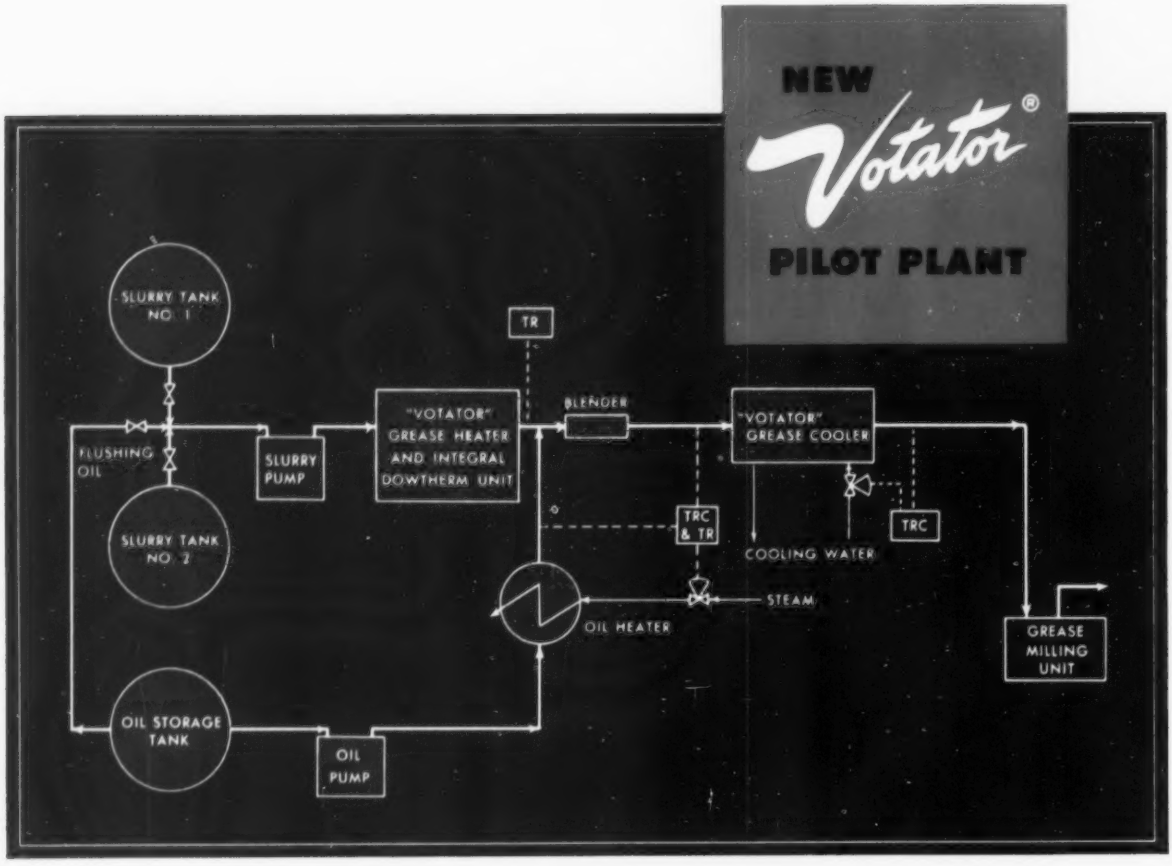

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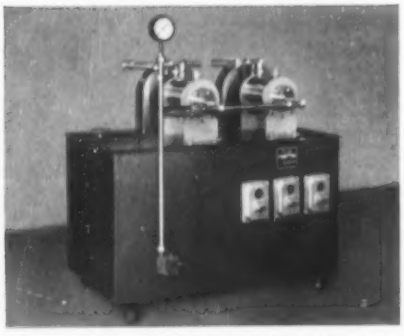

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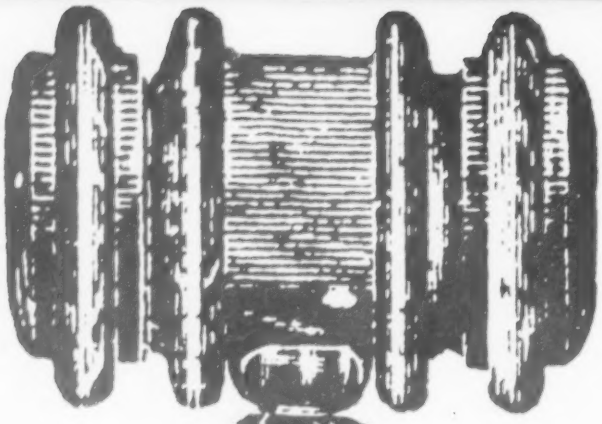

THE PRESIDENT'S PAGE

By J. W. LANE
NLGI
President

FUNCTIONS OF THE NLGI SPOKESMAN

What is the *NLGI Spokesman*? Nominally, it is an association journal. Of course, it is really other things as well. To the Institute as a body, it is the emissary that calls regularly, twelve times a year, not only on members and subscribers but also on the incidental readership. So, to the best of our ability and means, we try to have each issue attractive, informative and authoritative.

To the individual reader, it is a source of reliable information which helps him and his company to realize concrete benefits. Therefore, it must carry articles that will appeal to the varied interests of the readership—there must be balance, in other words, if we are to avoid saturating one segment while starving the other. And, where facts are involved, they must be accurate.

To the advertiser, actual or potential, it is a means of getting his own personal message to an audience which basically is deeply interested in what he has to offer. He can do this, too, at relatively small cost considering the direct and incidental readership involved.

All the above means work for the *Spokesman's* staff. Each issue must be carefully planned and there must be punctilious attention to mechanical details to avoid errors, both those which are serious and those which are merely annoying. Time is an ever-present factor, in order to meet deadlines for printing, binding and mailing.

There are concrete evidences that the *Spokesman* as a medium of expression and all the work required in its production do not go unrewarded. Subscription and readership are at a new high. Advertising space and revenues have both increased, to the point where the *Spokesman* is almost self-sustaining. Such has not been true in the past, a substantial allotment of other NLGI funds having been found generally necessary to balance the books each year.

Of great significance, last October the *NLGI Spokesman* was adjudged the second best of over 500 entries competing for an award offered by the Society of Associated Industrial Editors. Entries were judged on a broad basis covering editorial features, balance, writing quality, editorials, appearance and other pertinent factors. I think this is a tribute to the Institute and the *Spokesman* staff, as well as to contributors and advertisers.

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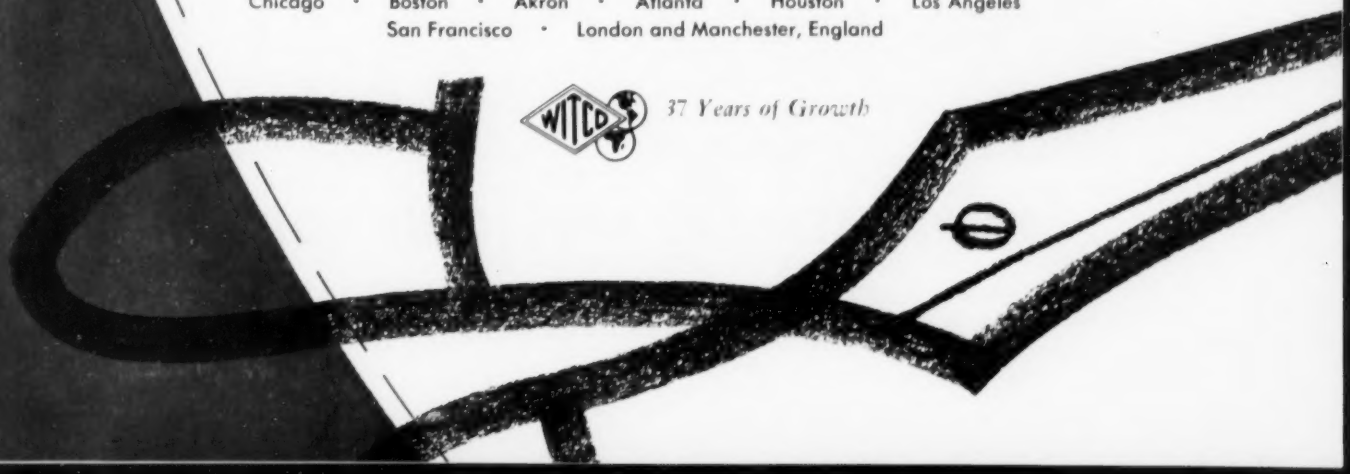

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Volume XX FEBRUARY, 1957 Number 11

nlgi spokesman

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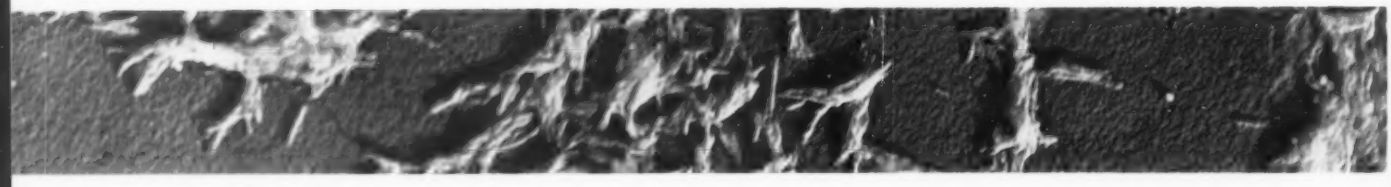
IN THIS ISSUE

THE COVER

Sodium N-octadecylterephthalamate, a new thickener, is made by reacting sodium hydroxide with the methyl ester of N-octadecylterephthalamic acid. This new synthetic thickener, developed by California Research corporation, is described and evaluated from the laboratory by authors Dreher, Hotten and Carter in their article, "A New Synthetic Thickener for Multipurpose Lubricating Grease" appearing on page 10. According to the authors, multipurpose terephlamate greases have broadened the range of high and low temperature performance.

A New Synthetic Thickener



for Multipurpose Lubricating Grease

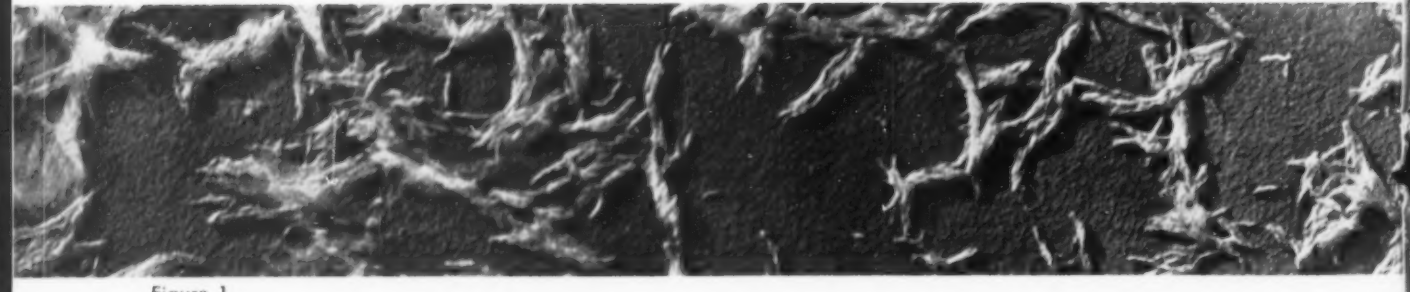


Figure 1

By J. L. DREHER, B. W. HOTTEN and C. F. CARTER
California Research Corporation

1 μ
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IN RECENT YEARS the major effort in lubricating grease reasearch has been on the development of new multipurpose thickeners. Notable examples of advances made in this direction are lithium base soaps, modified clays, and complex calcium and barium base soaps. This paper describes the laboratory evaluation of a new synthetic thickener developed by California Research corporation.

The new thickener is sodium N-octadecylterephthalamate. It is made by reacting sodium hydroxide with the methyl ester of N-octadecylterephthalamic acid, which is synthesized from dimethyl terephthalate and a mixture of octadecyl–and hexadecylamines.[1] Dimethyl terephthalate, which is made from paraxylene, is widely used in the manufacture of synthetic fibers and high melting plastics. The amines are derived from hydrogenated tallow.

Lithium and barium terephthalamates can also be used to make greases; however, the resultant products are generally not as good as are the sodium base greases. Accordingly, unless otherwise noted, the data presented in this paper pertain only to sodium N-octadecylterephthalamate greases, which for convenience are referred to as terephthalamate greases.

General Properties

The properties discussed below pertain specifically to terephthalamate grease made with paraffinic base mineral oils. In general, the properties are also typical for greases made with other types of mineral oil or with other fluids. Table I gives the typical properties of three greases which provide the bulk of the data for the following discussion. The greases contain oxidation and rust inhibitors.

Texture

The texture of terephthalamate greases is smooth and buttery, attributable to the very small fiber dimensions. The electron micrograph in Figure 1 shows that the fibers are slightly twisted rods, approximately 0.03 micron in diameter and less than 1 micron in length.

TABLE I

Typical Properties of Terephthalamate Greases

Grease	*A*	*B*	*C*
Terephthalamate Content, Wt. %	8	9.3	12
Mineral Oil Properties			
Viscosity at 100° F,SSU	500	500	600
Viscosity at 210° F, SSU	61	61	66
Viscosity Index	85	85	86
Unworked Penetration (ASTM)	325	260	220
Worked Penetration (ASTM)	345	290	250
Dropping Point, °F (ASTM)	520	580	580
Bearing Life at 300°F, Hours[a]	...	...	1290
Water Stability, Penetration[b]	364	330	318

a. Method 331.1 of Specification VV-L-791e

b. Procedure given in MIL-G-10924 (ORD) Amendment 3

High Temperature Properties

Terephthalamate greases have ASTM dropping points of approximately 580° F. These are softening points and not melting points, as sodium octadecylterephthalamate decomposes below its melting point. It has been heated in an inert atmosphere to 780° F without melting. At that temperature the decomposition became excessive.

As is well known, high dropping points are not necessarily indicative of excellent high temperature performance.[2] Many greases with high dropping points do not perform well for prolonged periods at elevated temperatures. However, grease C, made with a mineral oil having a moderate viscosity, gives excellent high temperature performance, as shown in Table I. It exceeds the minimum requirement of 600 hours at 300° F of high temperature grease specification MIL-L-3545 by a factor of more than two. Only the best conventional sodium base greases designed specifically for use at elevated temperatures equal Grease C with respect to high temperature performance.

With this new thickener, the temperature ceiling for multipurpose greases is raised above 300° F. The ceiling for the usual soap base, multipurpose grease is 250° F.[3]

Water Resistance

Greases made with sodium octadecylterephthalamate are extremely water resistant in contrast to conventional sodium base greases. They can be boiled in water for days with essentially no disintegration. In the water resistance test of specification MIL-L-3545, the average weight loss is 2.5%. When mixed with water, terephthalamate greases do not become excessively soft, as shown by the water stability data in Table I.

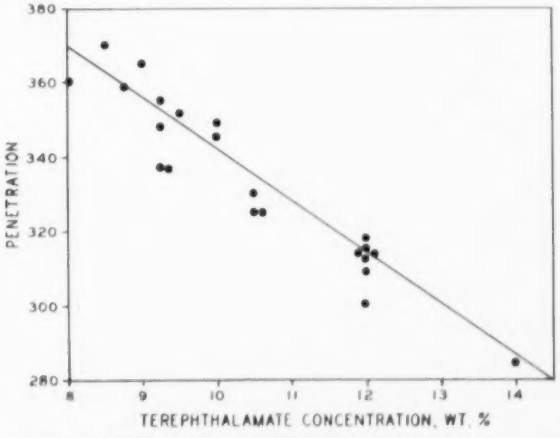

Figure 2—**EFFECT of terephthalamate content on penetration after 100,000 strokes (work stability test of specification MIL-G-3278). Test depends on thickener.**

Work Stability

Terephthalamate greases are very work stable, as shown by the results of tests in the ASTM worker and Shell roll machine. The actual test result is dependent upon the thickener content, as with other types of greases. The effect of terephthalamate content on penetration after 100,000 strokes in the work stability test required by specification MIL-G-3278 is shown in Figure 2. The data show that the usual specification limit of 375 maximum can be met with as little as 8% terephthalamate.

The stability of these greases in the roll test is shown by the data in Table II. For comparison, the data on two commercial lithium 12-hydroxystearate greases are included.

TABLE II

Comparison of Sodium Terephthalamate and Lithium 12-Hydroxystearate Greases in Roll Test

Grease	*A*	*B*	*C*	*D*	*E*
Thickener	*Terephth-alamate*			*Hydroxy-stearate*	
Thickener Content, Wt. %	8	9.3	12	8	14
Worked Penetration (ASTM)	345	290	250	284	230
Penetration, 64 Hours	382	347	309	345	342
Penetration, 1000 Hours	385	361	315	388	388

The data in Table II show that in the roll test sodium octadecylterephthalamate is equal or superior to lithium 12-hydroxystearate, widely known for its excellent work stability.

Compatibility

As a result of the large number of different grease bases introduced commercially in recent years, compatibility has become of increasing concern.[4,5,6] With many of the new multipurpose greases, the thorough removal of any preceding grease in a bearing is often mandatory for satisfactory operation. At times, the impracticability of completely removing the old grease precludes the use of the new grease. Lack of compatibility with other types of greases thus limits the use of some multipurpose greases.

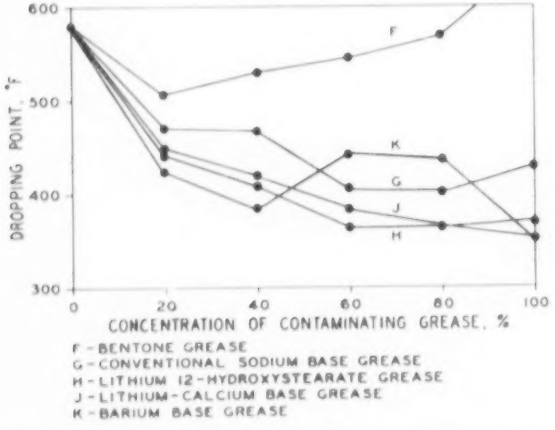

Figure 3—EFFECT on dropping point of contaminating terephthalamate grease C with other types of greases.

Terephthalamate greases are compatible with all common commercial greases. An indication of the compatibility of two greases is given by the dropping points of their mixtures. If the dropping point of any mixture is significantly below that of the lowest melting of the original greases, they are considered incompatible. In Table III are shown the dropping points of mixtures of grease C and five other types of greases. The data are shown graphically in Figure 3. In no case is the dropping point of a mixture significantly below that of the lowest melting of the original greases.

The dropping point of many multipurpose greases can be lowered by at least 100° F by contamination with other types of greases. Accordingly, the dropping point of the usual multipurpose grease, which is below 400° F, can be lowered to less than 300° F. This is below the operating temperature of some critical services, such as the wheel bearings on heavy duty trucks and buses. The effect on dropping point of contaminating a lithium 12-hydroxystearate grease with a conventional sodium base grease is shown in Figure 4.

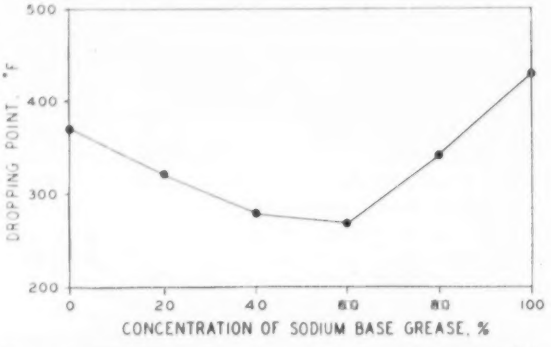

Figure 4—EFFECT on dropping point of contaminating lithium 12-hydroxystearate grease conventional sodium base.

TABLE III

Effect on Dropping Point of Contaminating Grease C with Other Types of Greases

Grease	*F*	*G*	*H*	*J*	*K*
Thickener Base	*Bentone*	*Conventional Sodium*	*Lithium 12 Hydroxy-stearate*	*Lithium-Calcium*	*Barium*
% Contaminating Grease	*Dropping Point, °F.*				
0	580	580	580	580	580
20	507	475	441	449	427
40	532	475	409	422	387
60	545	404	362	384	442
80	570	402	365	368	438
100	580+	430	372	355	369

TABLE IV

Comparison of Low Temperature Properties of Terephthalamate and Lithium-Calcium Stearate Greases (Prepared with same diester-mineral oil blend)

Grease	L	M
Base	Terephthalamate	Lithium-Calcium
Worked Penetration (ASTM)	270	282
Apparent Viscosity at −65°F, poises		
20 sec^{-1}	5100	9400
50 sec^{-1}	3200	4600
*Torque at −65°F, g-cm		
Starting	1832	4838
Running	266	295

*Procedure given in proposed Military Specification MIL-G-3278A.

TABLE V

Comparison of Low Temperature Properties of Terephthalamate and Sodium Stearate Greases

Grease	C	N
Base	Terephthalamate	Sodium
Mineral Oil Properties		
Viscosity at 100°F, SSU	600	500
Viscosity Index	86	85
Worked Penetration (ASTM)	250	270
Apparent Viscosity at 32°F, poises		
200 sec^{-1}	390	800

The compatibility of terephthalamate greases can also be demonstrated in machine performance tests. For example, in the ASTM grease leakage tester (D 1263-53T) and in loaded antifriction bearing assemblies, greases A, B, and C do not become abnormally soft due to contamination with the five types of greases shown in Table III.

Low Temperature Properties

Torque and apparent viscosity measurements show that terephthalamate greases have excellent low temperature properties, as illustrated by the data in Tables IV and V.

Rust Prevention

Terephthalamate greases can easily be made rust preventive with appropriate additives. Such greases made with either mineral oils or synthetic oils readily pass the bearing protection test of the proposed specification MIL-G-3278A. Greases A, B, and C pass this test. In another test, in which a bearing is coated with a grease, operated for a short time, and placed in an atmosphere of 100% humidity at 120°F, greases A, B, and C prevent rusting for more than 300 hours.

Oxidation Resistance

Terephthalamate greases readily respond to antioxidants. With a number of common oxidation inhibitors, they comply with the usual 5 psi maximum pressure drop in 100 hours in the ASTM oxidation stability test. Likewise in machine performance-type tests, they show excellent oxidation resistance. This is illustrated by the bearing data presented in Table I.

Other Fluids Thickened

Terephthalamate greases can be made with a wide variety of fluids other than mineral oils. Silicones, diesters, phosphates, polyglycols, disiloxanes, glycerine,

TABLE VI

Composition and Properties of Greases Made With Phenylmethyl Silicone

Grease	O	P	Q
Terephthalamate, Wt. %	10	15	20
Silicone, %	90	85	80
Worked Penetration	292	199	140
Dropping Point, °F	500+	500+	500+
Bearing Life, Hours[a]			
350°F	—	483[c]	—
400°F	—	—	185
450°F	70[b]	97[b]	—

a. Method 331.1 of Specification VV-L-791e
b. Average of Two Runs
c. Average of Three Runs

TABLE VII

Comparison of Properties of Terephthalamate-Diester Grease with MIL-G-3278A Requirements

Test	*Grease R*	*Limits*
Worked Penetration	270	260-310
Dropping Point, °F	572	325 min
Work Stability	318	375 max
Dirt Count	Pass	Pass
Oxidation Stability psi drop		
100 Hours	4	5 max
500 Hours	16	25 max
Copper Corrosion	Pass	Pass
Water Washing, %	2.0	20 max
Bearing Protection	Pass	Pass
Evaporation, %	2.2	2.5 max
Separation, %	3.1	5.0 max
Apparent Viscosity at −65°F, poises		
20 sec^{-1}	5100	10,000 max
50 sec^{-1}	3200	5,000 max
Torque at −65°F, g cm		
Starting	1832	5,000 max
Running	266	500 max
Gear Wear, mg/1000 Cycles		
5 pounds	0.85	2.5 max
10 pounds	1.87	3.5 max
High Temperature Performance, Hours	In Progress	1000 min
Storage Stability	In Progress	Pass

and water have been thickened. Greases of special interest made with some of the more important synthetic fluids are discussed below.

Silicones

The composition and properties of several silicone greases are given in Table VI. The data show that sodium octadecylterephthalamate is an efficient thickening agent for silicone fluids. The greases perform excellently at high temperatures. The bearing lives at 350°F and 400°F are about three times those of lithium stearate-silicone greases.

Diesters

The properties of a typical terephthalamate-diester grease are given in Table VII. The data show that grease R, which contains appropriate additives, complies with the proposed specification MIL-G-3278A for the tests completed.

Other Synthetics

The composition and properties of terephthalamate greases made with polypropylene glycol, tetra (2-ethylhexyl) silicate, and ditolylnaphthyl phosphate are given in Table VIII.

The polypropylene glycol grease was made in the same way as mineral oil greases. The glycol had a viscosity of 3 centistokes at 210°F and a pour point below −65°F. The bearing life of 3000 hours at 250°F is outstanding for a grease prepared with a fluid designed particularly for low temperature operations.

Sodium octadecylterephthalamate has high gelling power in silicate oils, as shown by the data in Table VIII. Greases of this type would be expected to have exceptionally good fluidity at low temperatures.

The data obtained on Grease U show that the phosphate fluid reduces the thickening efficiency of sodium octadecylterephthalamate. The grease has very good high temperature properties. Also, the grease has excellent extreme pressure properties. In the falex machine the load-carrying capacity of grease U is 3080 pounds, twice that of conventional mineral oil greases.

TABLE VIII

Terephthalamate-Synthetic Fluid Greases

Grease / *Fluid*	*S* *Polypropylene Glycol*	*T* *Tetra (2-Ethylhexyl) Silicate*	*U* *Ditolyl Naphthyl Phosphate*
Terephthalamate, Wt. %	15	8.3	25
Oxidation Inhibitor, %	5	—	—
Worked Penetration	246	305	264
Dropping Point, °F	460	500+	435
Bearing Life, Hours[a]			
250°F	3000	—	—
300°F	—	—	1244[b]

a. Method 331.1 of Specification W-L-791e

b. Average of Three Runs

Military Specifications

The versatility of terephthalamate greases is shown by the large number of military specifications under which they have either qualified or potentially can qualify.

MIL-L-3545 Specification

Most greases which qualify under this specification for high temperature greases are sodium base products. Usual multipurpose greases fail to comply with the high temperature performance requirement. Terephthalamate greases, however, can be made to qualify readily, as shown by the data in Table IX.

TABLE IX

Comparison of Test Results on Grease C and MIL-L-3545 Requirements

Test	*Grease C*	*Requirements*
Dropping Point, °F	580	350 min
Worked Penetration	250	—
Copper Corrosion	Pass	Pass
Dirt Content	Pass	Pass
Oxidation Stability, psi drop		
100 Hours	6	10 max
500 Hours	10	25 max
Water Resistance, %	3	50 max
Bearing Life at 300°F, hours	1290	600 min
Storage Stability	Pass	Pass

MIL-G-18709 Specification

As with MIL-L-3545, qualified greases under this specification are usually sodium base and not multipurpose. Terephthalamate greases can be made to meet the requirements easily, as shown by the data in Table X.

TABLE X

Comparison of Test Results on Grease C and MIL-G-18709 Requirements

Test	*Grease C*	*Requirement*
Dropping Point, °F	580	300 min
Worked Penetration	250	—
Copper Corrosion	Pass	Pass
Dirt Content	Pass	Pass
Apparent Viscosity at 32°F, poises		
200 sec^{-1}	390	900 max
Bearing Life at 212°F, hours	5300+	4000 min

ABOUT THE AUTHORS

J. L. Dreher is group supervisor of the grease research and development laboratory of California Research Corporation. He joined the company in 1945. Dreher obtained his A.B. degree in chemistry from the University of California in 1935 and began working for General Petroleum Corporation. In 1943 he joined the Metallurgical Laboratories (Manhattan Project), Chicago University, and was then employed by Hanford engineering works (a subsidiary of E. I. DuPont) in 1944. Dreher is a member of ACS, ASLE and American Association for the Advancement of Science.

Senior research chemist at California Research Corporation, Dr. B. W. Hotten graduated from Cincinnati University in 1941 with a B.A. degree and received his Ph.D. in organic chemistry from Purdue University in 1945. He spent an additional year at Purdue in research on organic fluorine compounds. Since 1946, Hotten has worked on the formulation and fundamental properties of lubricating greases at California Research. His membership in various organizations includes Phi Beta Kappa, Sigma Xi, the American Chemical Society and the Society of Rheology.

For the past sixteen years C. F. Carter has been engaged in the development and manufacture of lubricating greases with the California Research Corporation. Carter obtained his B.S. degree from Polytechnic College of Engineering in 1934. In 1935 he was employed by California Research, operating company of the Standard Oil Company of California. Carter has been a keenly interested member of ASLE.

Other Military Specifications

Development of terephthalamate greases to comply with other specifications has not progressed sufficiently to show complete compliance. Completed tests, however, indicate that terephthalamate greases can be made which comply with aviation and instrument grease specification MIL-G-3278, general purpose aviation grease specification MIL-L-7711, and automotive and artillery grease specification MIL-G-10924 (ORD) amendment 3. On the basis of available data, it appears that terephthalamate greases can be made which comply with all military specifications which do not contain specific composition requirements.

Conclusion

The laboratory data show that multipurpose terephthalamate greases match or surpass conventional sodium base greases in high temperature performance and lithium base greases in low temperature performance. Also, they are equal or superior to lithium 12-hydroxystearate greases in work stability. Thus, terephthalamate greases have significantly broadened the range of service conditions which can be met by multipurpose greases.

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FUTURE MEETINGS of the Industry

FEBRUARY, 1957

8-9 Symposium on Composition of Petroleum Oil ASTM (Committee D-2), Jung Hotel, New Orleans.

22 Natural Gasoline Association of America (Permian basin regional meeting), Scharbauer Hotel, Midland, Texas.

24-28 AIME Annual Meeting, Hotels Roosevelt and Jung, New Orleans.

26-27 API Division of Marketing (Lubrication Committee), Sheraton-Cadillac Hotel, Detroit.

26-27 Lubrication Committee API annual meeting with automotive industry, Sheraton-Cadillac Hotel, Detroit, Mich.

MARCH, 1957

11-12 Illinois Petroleum Marketers Association (35th annual convention), Hotel Pere Marquette, Peoria, Ill.

14-16 Texas Oil Jobbers Association (annual convention), Rice Hotel, Houston.

19-21 Ohio Petroleum Marketers Association (Spring convention and trade exposition), Deshler-Hilton Hotel, Columbus.

20-22 API Division of Production (Southern District Meeting), Washington Youree & Captain Shreve Hotels, Shreveport.

25-27 Midwest Gas Association meeting, Hotel Nicollet, Minneapolis.

27-29 American Power Conference meeting, Sherman Hotel, Chicago.

28 National Industrial Conference Board (general session), Sheraton-Palace Hotel, San Francisco.

APRIL, 1957

7-12 American Chemical Society (131st national meeting), Miami, site unreported.

10-12 API Division of Production (Mid - Continent District meeting), Mayo Hotel, Tulsa.

16-18 National Petroleum Association, Cleveland, Ohio.

18 National Industrial Conference Board (meeting of board), Waldorf - Astoria Hotel, New York City.

24-26 National Gasoline Association of America (36th annual convention), Rice Hotel, Houston.

24-26 API Division of Production (Rocky Mountain District meeting), Gladstone, Townsend & Henning Hotels, Casper, Wyo.

28-30 Independent Petroleum Association of America (midyear meeting), Buena Vista Hotel, Biloxi.

29-May 1 American Oil Chemists' Society (annual meeting), Roosevelt Hotel, New Orleans.

MAY, 1957

1-3 API Division of Production (Eastern District meeting), William Penn Hotel, Pittsburgh.

6-8 API Annual Pipe Line Conference, Cleveland Hotel, Cleveland.

6-8 API Lubrication Committee, Grand Hotel, Point Clear, Ala.

13-16 API Division of Refining (midyear meeting), Sheraton, Hotel, Philadelphia.

15-17 Fuel Oil Distributors Association of New Jersey (annual convention), Hotel Berkeley, Carteret, Asbury Park, N. J.

16-17 National Industrial Conference Board (general session), Waldorf - Astoria Hotel, New York City.

19-22 Texas Independent Producers & Royalty Owners Association (annual meeting), Galvez and Buccaneer Hotels, Galveston.

22-24 API Division of Production (Eastern District meeting), William Penn Hotel, Pittsburgh.

JUNE, 1957

9-14 API Division of Production (midyear committee conference), Muehlebach Hotel, Kansas City.

10-12 Interstate Oil Compact Commission (midyear meeting), Canyon Hotel, Yellowstone National Park.

16-21 ASTM, Chalfonte-Haddon Hall, Atlantic City, N. J.

24-25 Michigan Gas Assn. meeting, Grand Hotel, Mackinac Island, Mich.

24-28 American Institute of Electrical Engineers (1957 Summer general meeting), Sharaton-Mt. Royal Hotel, Montreal.

SEPTEMBER, 1957

11-13 National Petroleum Association (55th annual meeting), Traymore Hotel, Atlantic City, N. Y.

30-Oct. 2 American Oil Chemists' Society (1957 Fall meeting), Netherland Plaza Hotel, Cincinnati.

OCTOBER, 1957

1-2 Texas Mid-Continent Oil & Gas Assn. (38th annual meeting), Texas Hotel, Fort Worth.

6-9 AIME (Petroleum Branch meeting), Dallas. Site unreported.

7-9 American Gas Assn. (annual convention), Kiel Auditorium, St. Louis.

7-11 American Institute of Electrical Engineers (1957 Fall general meeting), Morrison Hotel, Chicago.

28-30 NLGI ANNUAL MEETING, Edgewater Beach, Hotel, Chicago, Ill.

Current Problems in Grease Lubrication of BALL BEARINGS

By C. H. HANNAN
Fafnir Bearing Company

IN PRESENTING this paper we are offering our experience on a number of important problems which must receive consideration in the every day use of grease lubrication in ball bearings. We are further putting these subjects before you with the thought in mind that for the most part they represent problems which we have not yet completely solved to our own satisfaction. We believe they merit the attention of those in the lubrication industry who supply us with many of our standard greases.

Inspection and Testing

We exercise careful control and a good deal of vigilance in the testing and inspection to which greases are subjected before particular batches are accepted for use in our plant. We check the greases for their conformance to whatever military specification is applicable; we check them for conformance to their chemical and physical characteristics as detailed in the information given us by the grease manufacturer. This involves oxidation bomb tests, low temperature torque tests, penetration tests, separation, corrosion and dirt count tests. On those greases which go into special applications such as aircraft control pulleys, before a batch of one of these lubricants is accepted it must meet the government specification for service life under predetermined test conditions. We will discuss this subject more fully.

Of all the tests which we perform on greases as they are received in our plant, it is the penetration, oxidation and dirt count tests which are usually the most discouraging.

Our method of handling greases is to transfer them in an air conditioned area from the shipping container to a rock crusher type of pumping unit which puts the grease under pressure through a line to the greasing station. Here it is introduced into the bearing in

Continued on page 18

Authenticated News Photo

An automotive ball joint suspension and steering unit gets experimental shot of grease on vibrating device.

Discussion by E. M. Higgins appears on page 21

metered quantities. Variations in consistency from batch to batch and often within a batch have an important effect on the accuracy of our metering devices. If the consistency stiffens as we get down near the bottom of the barrel, we will find ourselves putting a lesser and lesser quantity of grease into the bearing. The variation in amount delivered to the bearing which can be directly attributed to lack of uniformity in consistency can exceed the tolerance on the quantity which the bearing must receive. Variation in batch consistency can cause rejection of large quantities of grease. So far no good explanation of or control over this variation has been available.

Oxidation Tests

Failure of particular batches of any lubricant to pass our oxidation bomb test after this particular lubricant has established a good reputation for itself on this test can often cause us a good deal of trouble. The number of greases which we use as standards is relatively small because we do not accept a grease as a standard until it has performed satisfactorily over a period of time in a number of applications. There are relatively few lubricants which can thus qualify. When several of these lubricants start to give us trouble by failing to pass our oxidation bomb test then we find ourselves with bearings to grease and no good grease to put in them. We have discussed this problem with all its ramifications with our grease suppliers and to date no one can tell us exactly why one batch of grease will pass the oxidation bomb test and the next will fail.

To date no manufacturer has found a quick, efficient and sure way to take a bad batch and reprocess it so that it becomes acceptable on oxidation tests.

Dirt

Dirt is a big problem. Dirty grease means we must exercise close control on greasing equipment to be sure that the filters on our grease lines are kept clean so that they will efficiently trap all foreign particles. Depending on the consistency of the lubricant being pumped, we insert a series of wire mesh screens into the grease line with meshes running from 110 to 280. These filters stop a great deal of foreign material which is in the lubricant. A dirty batch of grease will clog a filter up solidly in less than eight hours but a clean batch of grease will let us leave the filter on the line for two or three days. If we were able to buy clean grease, at least cleaner than that which we now get, it would cut down our service time on our filters which is an important factor to a production facility.

An even more important effect of having dirty grease is that some of the dirt is bound to get through the filter and into the bearings. Many of our applications are very sensitive to noise and to smoothness and the presence of dirt in the grease serves to increase the noise level of the bearing while it is running, producing an intermittent roughness sound when the unit is started or first put into operation which we cannot possibly stand. The second effect of having dirt in the grease is that should we ignore or be unaware of the dirt in the grease when the bearing is first put into service, then we get a lapping condition with a roughening of the race and ball surfaces within the bearing, which increases the over-all noise level and which can if the amount of contamination is extreme, shorten the bearing life by aggravating the rate of wear on the bearing parts.

A good many standard greases are used in bearings which go into some very special and very demanding applications from the standpoint of noise and life. This means that we must exercise all possible caution regarding cleanliness within our shop, and that we must ask our grease suppliers to make the lubricant as clean as they possibly can when it is delivered to us.

Noise in Use

Bearing in mind that we are discussing only standard greases for use in applications which preclude extremely high and extremely low temperature and any extremely special bearing applications, we must mention the effect of noise produced in a bearing by a lubricant after the bearing has been in service for a short period of time. We do not expect any grease lubricated bearing to be as quiet as its oiled counterpart when it is first put into service because we realize that the grease must be channeled out of the ball track and must find a position of equilibrium inside the shields or seals or the end parts of the unit. This takes time, anywhere from a half minute to a half hour.

The factor which causes us a good deal of concern is that of two or three of our standard lubricants for electric motors, only one can be used regardless of bearing size because of a squealing phenomenon that develops within the bearing with certain greases. We have not been able to determine that a hard grease will give us this noise and a soft one will not.

We do know that this noise is not in any way tied to surface finish characteristics within the bearing. We do know that the effect of dirt has been already taken care of. The phenomenon of which I am speaking is one such that if you take a No. 209 bearing, for instance and lubricate it with grease "A" it will be smooth and quiet. Put grease "B" into the same bearing and while the characteristics of grease "B" and grease "A" are as identical as you wish to make them, as soon as we start the motor we get a high pitched squeal or whine which will not go away.

This squeal is only slightly affected by the internal fit within the bearing, the external preload applied to the bearing or the mounting of the bearing onto the parts of the motor. It has sufficient volume and intensity to drive you out of the test room. This is a complaint which we make of one of our standard lu-

bricants which hitherto has given us no trouble. The only difference in the use of this lubricant is that previously we had used it only in relatively small bearings, say up to a 205 size at which time it did not evidence this noise. As soon as we put it into a larger bearing, say a 209, we get this squeal which the motor manufacturer cannot stand and which the grease manufacturer so far has been unable to explain.

Leakage and Storage

Current philosophy in electric motor manufacture and for that matter in the manufacture of many of our mass produced components these days is that they be completely prepared for their end use during their manufacturing cycle and that they then be stored on the shelf and left unattended until they are required. In the case of a grease, this means that once it has been put into a bearing it must have good storage life.

Storage life of grease to a bearing manufacturer means two things. It means that while the grease is in the bearing, it must not separate excessively so that the oil leaks out and contaminates the package nor can it leave a soapy residue within the bearing which has little or no lubricating value. It also means that while the bearing is on the shelf the grease within it must give adequate protection against corrosion and rusting due to atmospheric conditions which we are going to encounter in most stock rooms. We would like to limit the storage time, with which we must be concerned, to perhaps a month or two at most. However, we know that this is a completely unrealistic figure and our bearings as prelubricated must be expected to be in excellent condition from two to five years after the date of packing when they may be first put into use.

There are several popular lubricants which are offered to the bearing manufacturers and to the maintenance field as ball bearing lubricants which do not meet these requirements. One group for instance shows an excessive bleed rate in storage. In no time at all whether the bearing be opened or closed, that is with or without seals or shields, we will find that a good percentage of the oil has bled out of the soap leaving us with an unserviceable bearing. Another group of lubricants is used in prelubrication and relubrication but offers little or no protection to the bearing while it is on the shelf.

We have had a number of our grease suppliers investigating this particular problem for two reasons. The question was brought up, and well it might have been, asking, whether the grease is protecting the bearings during storage or if it is actually inducing and furthering corrosion within the bearing while it is on the shelf.

Useful storage life was found by actual test to be about three months with several of these lubricants. Yet when we used these lubricants only for relubrication, we found that they were excellent. They met all our requirements. This further limits the number of general purpose greases which we can use because any lubricants which exhibit these characteristics must of necessity be removed from the acceptable list and will only be used at customer insistance.

Hard Particles

Another phenomenon which is a source of worry to us can be classed under the title of "hard particles." Many of our lubricants which are used for normal temperature range applications must meet some military standards. Also the largest proportion of our lubricants are purchased with inhibitors and rust preventatives built into them. The presence of these inhibitors and rust preventatives has caused us a good deal of trouble with a number of greases because they do not seem to be completely homogenized into the structure of the grease.

We will put a quantity of a grease into a bearing and run it. It will be a little noisy but after the bearing is run for a short period of time the noise will decrease and finally the bearing will quiet down and be very acceptable.

If the same bearing is put back on the shelf and left

About the Author

C. H. Hannan *was recently appointed engineering manager for instrument application of the Fafnir Bearing company in New Britain, Connecticut. A 1951 Yale University graduate, he received the degree of Bachelor of Mechanical Engineering. Following graduation Hannan was employed by Fafnir in the field of application engineering. For the past four years his work has been primarily concerned with electric motors and instruments, and with particular interest on the design of bearings for and their application to these types of equipment.*

for any length of time from eight hours to two weeks, and then put back on the spinning arbor again, the same high noise level will be present at the commence of the test and will then decrease back to the same good level which was evidenced earlier. This is a characteristic which we cannot stand because the application of these bearings in many cases means that they must be quiet and smooth all the time. The people who use the units are unfamiliar with the internal characteristics of the bearings and in many cases they are not too familiar with what the application of the unit itself is. Any noise of an unexplained nature which they hear is usually cause for worry.

The second factor of this hard particle problem is that when the particles are large enough to be heard in the bearing when it is run on a spin test, then some of them are large enough to be filtered out by the filters in our grease lines when the bearing is being lubricated. If this is the case, then it stands to reason that once we have filtered the grease we have pretty efficiently removed all the inhibitors and any of the beneficial characteristics of the inhibitors have been lost to the lubricants.

Now the question that we would like answered is how do we go about buying greases with the inhibitor homogenized into them so that first of all we can't filter them out in our filtering mechanism and secondly, so that they do not tend to reform each time the grease is run and allowed to rest. Is this phenomenon of crystalline growth an unsolvable problem?

Specification Conformance

A large number of our aircraft bearings are built into pulleys. All of these bearings must be lubricated with a grease which meets MIL-G-3278. Theoretically, based on the military specification which covers this lubricant, any grease meeting the specification should be satisfactory for use in these pulleys. Such is not the case and this points up another problem with which the bearing companies must tangle. Just because a grease meets a military specification does that mean that it is acceptable for use in applications such as those for which the specification was intended to service? The answer is no. In conjunction with Wright Field, Fafnir has developed a test to which aircraft control pulleys are subjected. This test consists of mounting a KP4K, ¼-in. bore pulley bearing on the test rig in such a manner that a 3/16-in. cable loaded to a cable tension of 625 pounds with a 90-degree wrap around the bearing and 13½-in. cable travel produces a bearing load of 885 pounds at 124 reversals per minute. The military specification requires that the grease be satisfactory to meet a minimum of 35,000 reversals. Our Fafnir standard is a minimum of 40,000 reversals.

We have found that of the eight or ten greases that are on the qualified products list which is part of MIL-G-3278, only two or three of these would perform satisfactory in our pulley test. Admittedly this is an extremely tough test with very high loading and heavy stresses on the races resulting in very high loads on the lubricant film between the race and the ball. This test is the result of field trouble which developed with these control bearing pulleys because of grease breakdown and we now make a pulley test part of the acceptance test for any MIL-G-3278 grease. Four pulleys are put on the test rig and must attain a minimum of 40,000 reversals with any premature failures being solely the bearings' responsibility because of early fatigue of some of the bearing parts before the particular batch of lubricant is accepted. In case of doubt the test is rerun so that the grease manufacturer gets the full benefit of any doubt.

The question that we would like answered here is how do we go about procuring greases to a military specification which will perform satisfactorily in the application for which the specification was designed? This is a big problem with us because our total usage of these military specification greases in terms of poundage is considerable in the course of the year. Accordingly, with delivery and availability being a problem with everybody we like to have as many qualified suppliers as possible. However, when factors such as variations in life come into the question, then we are forced to discriminate.

Heat and Power Consumption

A large quantity of grease is used each year in electric motor bearings. The characteristics which we are looking for in greases for electric motors are that they be quiet and smooth, that their power consumption be low, and that they be of the channeling type so that a minimum amount of heat is developed in the bearings. Further they must be long-lived both in usage and in storage. We expect that when we first start up a motor with new bearings in it that the torque required to turn the unit will be high because the bearings have not been run to allow the grease to channel very effectively. Once this initial run has been made, we expect that the power consumption should stay down in a number of stops and starts. We do not expect that the bearing temperature should rise any more than 25°F., above ambient due to the working of the lubricant as well as the seal friction if any and we have set these limits as close as we can to the maximum variation which the motor manufacturers will accept and the minimum which we can control.

In summary, may we say that the foregoing does not represent all of our problems with grease lubrication. I wish this were true—rather these are typical, every-day problems which we must face and in the solution of which we invite your cooperation.

DISCUSSION

on Current Problems in Grease Lubrication of Ball Bearings

By E. M. Higgins, Master Lubricants Company

MR. HANNAN has well presented the many problems which beset a large grease user, particularly where the results of their judgment, good or poor, are widespread among their customers. As pointed out, many machine and component manufacturers rely on their bearing suppliers to furnish a completely prepared bearing which must of course, contain the proper grease for their particular application.

Ball bearing lubrication and all its associated problems have no doubt had the greatest influence on the development of better greases over the past decade.

Although Mr. Hannan's paper deals only with conventional or standard greases, those suited for normal operations, such problems of lubricant selection become more acute with abnormal or extreme applications. Thus, bearing companies must obviously turn to grease manufacturers to engineer and supply products which will fulfill their exacting requirements.

It is also fitting to congratulate the author on his excellent program of inspection and/or surveillance over the greases utilized to pre-pack his bearings.

Greases are highly complex mechanisms and slight variations of the values of their component parts can change their functional values many times quite severely.

As to oxidation our studies have indicated that differences in oxidation stability may be attributed to:

Variations in the quality of raw materials used to compound grease;

Variations in the quality of the additives employed;

Variations in the techniques used to incorporate the inhibitors;

Deviations in grease processing methods have also been found to contribute to the instability of the finished product.

No doubt most manufacturers of greases are doing everything possible to keep their products clean. While we pay considerable attention to this phase, it is obvious that filtering equipment such as would be found in a ball bearing plant would be too critical to obtain a fair production rate for a grease manufacturer.

Noise in bearings after a grease has been applied has presented problems for many years. Some greases become stiffer upon working, while others become softer. These consistency changes could reproduce different sound levels.

The structure of a given grease is not always the same. By this we mean varying from smooth to fibrous, although a fibrous grease is not necessarily noisy. It could become fibrous upon heating and cooling. Textures can change as a result of bearing shearing forces.

We know too, that temperature variations from low to high can give variable decibel readings.

Varying amounts of grease applied can make a difference. Even the initial distribution of a grease in a bearing has been known to make a difference, for instance, application of all grease on one side with none on the other.

The length of storage life of most pre-pack bearings cannot be predicted as Mr. Hannan brings out, therefore prevention from corrosion is of great importance.

Many tests conducted by us indicate that from one angle alone, greases which will not pick up moisture offer poor corrosion prevention ratings in storage.

The so-called salt water spray tests do not predict performance values of a grease, where moisture exists, in its ability to prevent corrosion. The subjection to moisture conditions is not long enough especially when you are considering what might happen during five years of storage. Corrosion inhibitors have been known to deteriorate or dissipate during extended periods.

Hard particles in grease would indicate improper or incomplete processing. They also could, of course, result from re-crystalization of inhibitor particles, as Mr. Hannan indicates.

One thing we know better and better all the time is that laboratory tests sometimes fall far short in their ability to predict field performance of greases.

In conclusion the grease manufacturers are doing everything possible today to provide materials which will overcome the many problems so well outlined by Mr. Hannan and it is expected as time passes the quality of commercial greases will show steady and persistent improvement. ■

Selling Customer Benefits

By C. E. GORE
Battenfeld Grease and Oil Corporation

THE SELLING of customer benefits can and must be broken into three broad classes, the industrial market where precision, highly specialized lubricants are used, the service station market, generally a "captive" market with little selling required, and the vast consumer market of farmers, contractors, heavy machine operators, truckers and other smaller volume purchasers.

Most marketers interested in servicing the industrial account maintain staffs of qualified lubrication engineers for contact. I certainly do not subtract from the sales ability of this group but must point out that often the decision to buy is made by laboratory technicians as a result of testing procedures and the meeting of well laid out specifications. No matter how skillful the salesman might be, he is still faced with the fact that his product must be made a certain way out of certain materials before it will be considered. Often his competitor has the same specification grease and then it boils down to service and price. While he still has the customer benefits of company integrity, location, research facilities and activities, etc., etc. to offer, the fact remains that his approach is extremely limited. No doubt but just plain customer service is a ranking factor in the success of the industrial salesman.

Little can be said about the service station market. There are few independent service stations left that are prospects for branded greases. While there are some notable and shining exceptions, most sizable independent chains are cut-rate gasoline outlets and frequently do not even offer lubrication facilities. Those that do have lube bays lean toward private branding and in most instances are not prospects for a marketer salesman. The overwhelming majority of stations offering complete services are major owned or major franchised operations and therefore pretty much a captive market.

There are certainly some challenging sales opportunities to be found in both the industrial and service station markets, but because these opportunities are generally "special" situations and therefore of limited interest, this paper will primarily deal with the consumer market.

Of the three markets, the consumer field offers the greatest opportunity for creative salesmanship and also poses the sheer necessity for skillful presentation of customer benefits. There are two major reasons for this. (1) Unlike the industrial market, little or no grease is bought on specification. (2) The purchasers are tied to no particular marketer and will buy from the salesman offering the most benefits for the money. These two facts throw the market wide open for a free-for-all fight between marketers.

We all recognize that lubricating grease is important to a marketer completely out of proportion to the dollar value of the product or the gallonage attained. Grease undoubtedly ranks right at the very top as a prestige item with oil companies. The public,

Continued on page 24

NEEDED:

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and particularly that portion of the public actually purchasing and using lubricating greases, quite often judge all of the products of the marketer by the quality of the lubricating grease offered. As the progressive marketer recognized this fact he immediately began the upgrading of grease products in his line in order to put his best foot forward. Today most marketers attempt to deliver to the public the finest possible lubricating grease they can manufacture or obtain. Net results? The public is able to obtain greases of tremendous high quality at reasonable prices. We recognize this truth, but unfortunately the consumer does not and must be convinced.

To do that convincing we must first realize that we are selling customer benefits to the ultimate consumer. Because he has no scientific background or training in our field, many of the things which are of extreme importance to us mean little or nothing to him. Our avenue of approach to this consumer must necessarily be on a completely different level and through completely different methods than we are ordinarily accustomed to dealing in. Most important, we must realize that we are not going to be able to approach the consumer directly. We are working through our sales force and more specifically through the individual sales people who are actually contacting the consumer. Scientifically we cannot approach this consumer on a technical basis. To get his business you must over simplify the facts and emphasize relatively unimportant points. The end result is to get your product into the user's hands. Once it is in his hands we know that the quality of the grease we are supplying will do the job.

Another factor in lubricating grease's importance to the marketer is due to its frequent use as a door opener for new business. An aggressive, well-informed salesman will use his lubricating grease line to arouse the interest of a prospect and then work into his other higher volume items as his grease gains the respect and confidence of the purchaser.

Why is grease easier to sell than other, more used products? I think the reason is rather obvious. You are simply able to approach the prospect through more mediums than possible with other less easily handled and easily demonstrated items. In other words the prospect can see the grease, can feel the grease, can smell the grease. The prospect is looking at something he feels he is familiar with. He has always used grease of one kind or another and probably formed some definite ideas about what he wants. The same fellow, when faced with remarks about MIL-L-2104 or Series 2 oils, etc., generally is pretty mystified by the terms and just a little bit afraid to enter into a discussion. However, because of his feeling of familiarity with lubricating grease he stays right with the salesman all the way through the presentation.

Currently the biggest problem the marketer has is lack of information on the part of the salesman making the presentation. When we talk about selling customer benefits we must first look to the fellow on the firing line, the bulk wagon or consumer salesman and start figuring out ways of assisting him in making his presentation. Let's face it; no one is going to sell any benefits to any customer of your company unless you put your salesman who is doing the actual contacting out into the field armed with a working knowledge of his product, which in turn will give him confidence in his ability to present it. We must also tell him and show him *how* to present it.

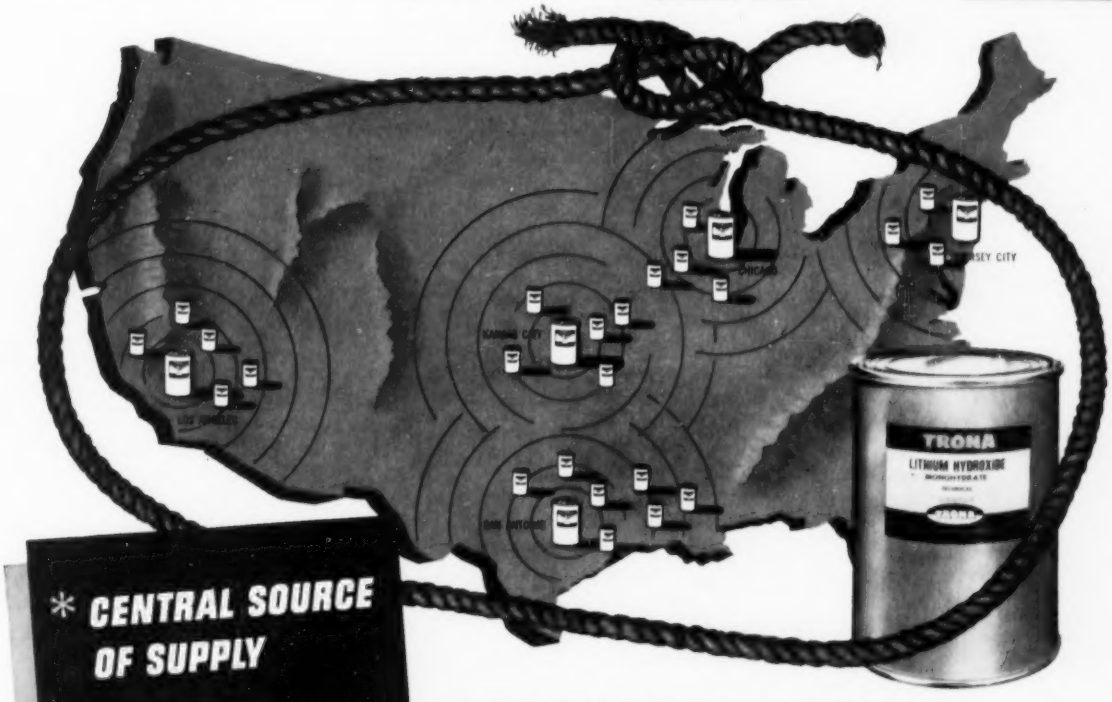
Too often we tend to depend on the extensive advertising and sales promotion programs of our companies to inform our sales departments and ultimately our consumers. We are well informed on our level, and consequently when we see brochures, advertisements or hear radio and television programs the message gets through to us rapidly. We sometimes fail to realize that the reason this message gets through to us so rapidly is because of our vital interest in what the message has to say, and we fail to realize that the same interest does not exist, except quite casually, in the mind of the consumer or the prospective consumer. If you were to get out into the field you would find out that wonderful advertising and sales promotion program has reached only a very small percentage of the prospects. Perhaps McGraw-Hill will not agree with me on the power of advertising, but I feel that even at the best, advertising is merely a minor tool in the hands of the point of contact salesman. It might possibly help him some to make his initial contact, but after that contact is made then it is completely up to the salesman to get the job done. I personally feel the "pre-conditioned

"DEMONSTRATE! Get the lid off that bucket and get your hands right down in that stuff. Create the desire to buy."

TRONA† LITHIUM HYDROXIDE

FOR MULTI-PURPOSE GREASES

...an essential product—tied in with service



* CENTRAL SOURCE OF SUPPLY
* STRATEGIC WAREHOUSING
* BETTER DELIVERIES

TRONA

GREASE MANUFACTURERS: There are three good reasons why Trona† should be your prime source of supply of lithium hydroxide monohydrate ($LiOH \cdot H_2O$), essential to the production of lithium base greases. (1) **A new and strategically located plant** at San Antonio, Texas (American Lithium Chemicals, Inc.). (2) **Convenient warehouse stocks** of lithium hydroxide, maintained in proximity to the major grease producing areas of the U. S. (see map). (3) **Better, faster deliveries,** because of advantageous rail and motor freight facilities. When planning your current, or future, requirements for LiOH we suggest you contact your American Potash & Chemical Corporation (Trona†) sales representative. His better service costs no more.

American Potash & Chemical Corporation

LOS ANGELES • NEW YORK • ATLANTA • SAN FRANCISCO • PORTLAND (ORE.)

†TRADEMARK AP&CC

Producers of: BORAX • POTASH • SODA ASH • SALT CAKE • LITHIUM CHEMICALS • BROMINE CHEMICALS • CHLORATES • PERCHLORATES • MANGANESE DIOXIDE *and a diversified line of specialized agricultural and refrigerant chemicals.*

Plants: TRONA and LOS ANGELES, CALIFORNIA
HENDERSON, NEVADA
SAN ANTONIO, TEXAS (American Lithium Chemicals, Inc.)
Export Div.: 99 PARK AVENUE, NEW YORK 16, NEW YORK

"A farmer says 'I leave my equipment in my barnyard; will your grease hurt my cattle?' the answer makes the sale."

mind" the advertising men like to tell us about is pretty much a myth in our type of selling.

Some companies are so large and cover such wide marketing areas that the response to any product introduced insures a substantial volume. Management can get pretty complacent about the job the advertising and sales promotion departments have done. Perhaps if they were able to take a good long look at the real potential volume and to check their percentage of the market against that potential, they would not be quite so complacent. Perhaps they would start diverting some of their advertising budget to a more comprehensive sales program on the first line of contact—the man who is going to deliver the results, the bulk wagon driver or consumer salesman. For the purpose of this paper we will consider them one and the same.

Regardless of the intensity or the extensiveness of a advertising program, sales promotion program or public information program, the final success of the program is going to lay with the consumer salesman and he is the fellow that we are going to have to put our sales emphasis on.

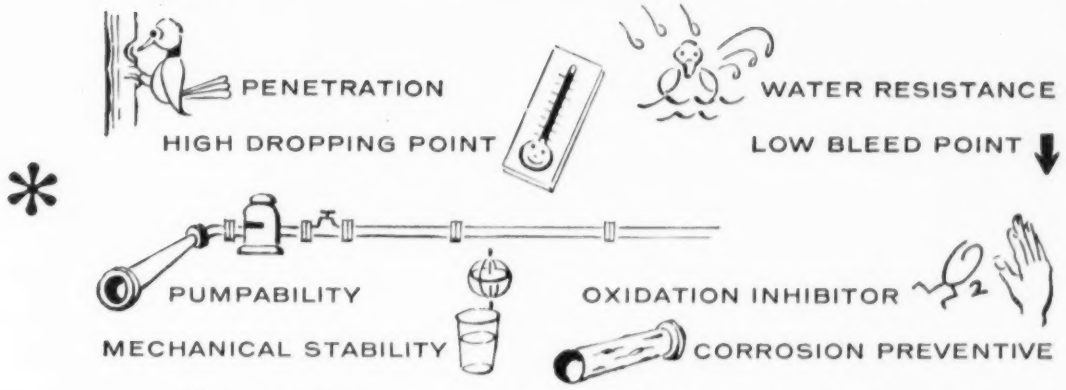
In a given territory you can find two consumer salesmen working side by side. They will be working approximately the same number of accounts and approximately the same class of trade. Yet one of them will sell many times as much lubricating grease as the other. The reason is simple. A man will sell only what he is familiar with. The successful grease salesman simply has confidence in his ability to present, while the other fellow lacks the confidence because he lacks the knowledge. Therefore what points can we cover, to instill that confidence in our sales people? What are the selling points of lubricating grease?

First and foremost in importance, regardless of any other feature, is demonstration. So far as I am concerned the subject of this paper should be "Demonstating Customer Benefits" instead of "Selling Customer Benefits." When your man is talking to the prospect make sure he is talking with an open sample of grease in his hand and is some way demonstrating the value of the product to the prospect. It does not matter whether he is stringing out the grease to show that wonderful clarity or whether he is spreading it out to show the tough adhesiveness of the dark product, just so long as he is actively doing something in the way of a demonstration. You may smile at the old "selling through the eyes" routine, but, it is the basis of all selling. When you buy a new automobile, whether you realize it or not, you have been sold through the eyes. The same is true whether you are buying a suit of clothes, a baby buggy, a new chair for the house, or a desk set for your office, some one is selling through the eyes. Just think a little, yourself, of some of the people who have called on you in an effort to sell you something. What fellow got the most house? The man who sat quietly and made a verbal presentation, whether it be fluent or otherwise, or did you pay more attention to the man who demonstrated to you in your office, either in the form of writing figures on a pad, showing you the mechanism of the product, or the color of a new oil. Well, the same is true in selling grease. In fact, even more so. Get that prospect's eyes tuned in on that grease while you tell him what a wonderful job it is going to do for him, and you are creating the desire to buy. That fellow can just visualize that fine looking grease protecting the bearings on his equipment and saving him loads of money. Demonstrate, gentlemen. Get the lid off that bucket and get your hands right down in that stuff.

I have talked to salesmen who have told me of their inability to sell a track roller grease to a caterpillar operator for 16 cents a pound, while some competitor has come in and sold the same grease for 30 cents. The difference—demonstration. While the one salesman is able to give a perfectly coherent and scientific dissertation covering the important points of his company's lubricating grease, the other salesman has approached the prospect from the more practical angle of what the grease will do for him with an actual demonstration. He will take a handful of the grease in his hand and form a "seal within a seal," showing how the grease will protect his tractor roller from picking up contaminants and dirt; he will string the grease out in his hand showing him the adhesiveness of the product and all the time while he is demonstrating he is pointing out the customer benefits the consumer can

Grease Chemists:

Only Lithium Hydroxide-Base Grease Offers the Correct Balance of Critical Properties* Necessary for Proper Lubrication Performance



* The action of lithium as a gelling agent dominantly controls the first four of these functional properties. Fatty acids, oil and auxiliary additives influence the last four. Lithium does not adversely affect any of these critical properties.

There are definite manufacturing and marketing advantages in producing lithium-based grease. Inventory control is but one of them. Being a true multipurpose product, only one lithium soap grease is needed to lubricate your car: chassis, water pump, wheel bearings and universal joints. Often, several single-purpose lubricants are replaced in special industrial applications. Of equal significance is Lithium Corporation's acceptance in the field: over 10 years' production experience supplying lithium hydroxide to the grease industry. Add to this our unsurpassed production facilities and you are assured of a reliable source of consistently uniform quality LiOH, available from inventory for immediate shipment. Since we are equally interested in developing better lithium products, why not get in touch with us? A card or letter will bring immediate response.

... trends ahead in industrial applications for lithium

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2575 RAND TOWER, MINNEAPOLIS 2, MINN.

PROCESSORS OF LITHIUM METAL • METAL DISPERSIONS • METAL DERIVATIVES: Amide • Hydride • Nitride • SALTS: Bromide • Carbonate • Chloride • Hydroxide • SPECIAL COMPOUNDS: Aluminate • Borate • Borosilicate • Cobaltite • Manganite • Molybdate • Silicate • Titanate • Zirconate • Zirconium Silicate

BRANCH SALES OFFICES: New York • Pittsburgh • Chicago • MINES: Keystone, Custer, Hill City, South Dakota • Bessemer City, North Carolina • Cat Lake, Manitoba • Amos Area, Quebec • PLANTS: St. Louis Park, Minnesota • Bessemer City, North Carolina • RESEARCH LABORATORY: St. Louis Park, Minn.

expect from his grease. And he makes the sale at twice the money.

The same is true on a farm where a simple answer to a simple question like "I leave my equipment in my barnyard; will your grease hurt my cattle?" can be the difference between making the sale and not making the sale. One salesman can tell the farmer that his grease is pure in composition and then go on to explain that his company uses only the finest of selected fatty acids, hydroxides and the various additives to insure that a pure product is put in the field. But the other fellow who makes the sale is the one who will pull a handful of his grease out of the container and show it to the prospect and tell him in no uncertain terms that his grease is as pure as "apple butter" and will not harm his livestock in any manner and at the same time demonstrate to the farmer that purity by something as spectacular as touching the grease to his lips.

Perhaps that is a little far fetched, but there has been many a sale made on a presentation just as extreme. And some back area consumers wouldn't want any of that "fatty acid" on their equipment.

Our job then is to equip the salesmen with an easy to understand presentation to go along with an applicable demonstration. We can find those demonstrating features from any one of the following points:

1. *Appearance*. It really is not important whether your grease is soda, calcium, lithium, aluminum, or what-have-you when it comes to making a presentation. If you have a clear, transparent product, enhance that point with your sales personnel. Point out to them the purity of product, visible purity of raw material and manufacturing process. If, however, your particular grease happens to be dark and fibrous, point out to your people how much better it is to have a tough, dark, serviceable fibrous grease instead of a pale, transparent, obviously light structured grease. In other words, take a direct look at the appearance of the product you want to sell and build a story around it.

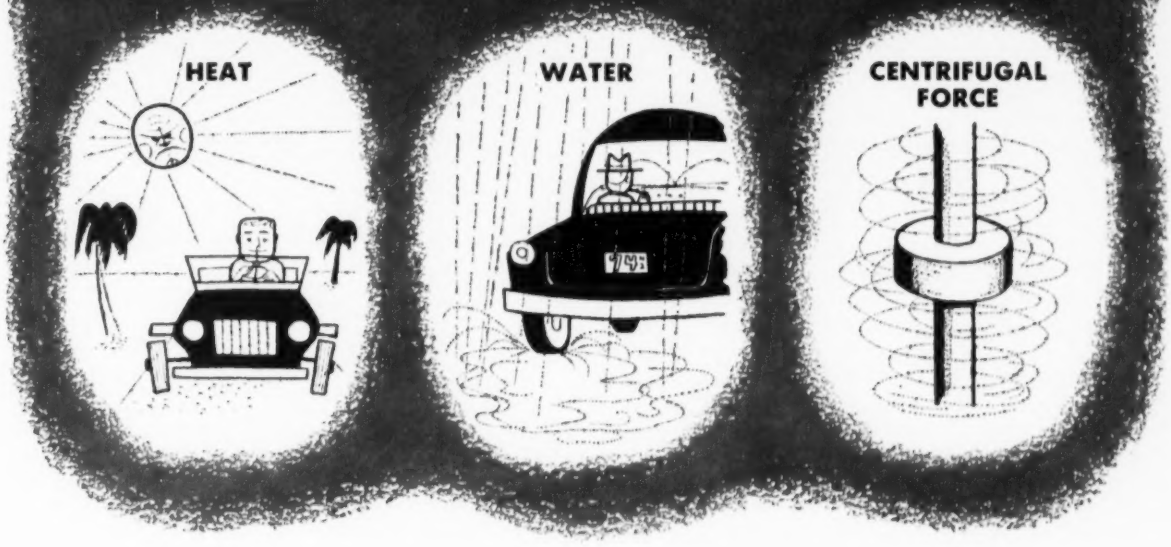
2. *Consistency*. Whether your best selling product is of 0, 1, 2, or 3 consistency is of no particular importance as far as selling is concerned. The only important thing is that your salesman is able to point out to the prospect that his particular consistency is the most desirable. Any one knows that a nice soft, light consistency grease flows easily down into the rollers or bearing surfaces and spreads out, giving the utmost in protection. Of course if you happen to be selling a grease of a little heavier consistency, perhaps it would be better to point out that the soft grease runs right through the bearings and out on the ground, leaving drippage in the parking areas and fails to stay on the vital surfaces in heavy enough quantities. Build your story around your consistency.

"THAT fellow can just visualize that fine looking grease protecting the bearings on his equipment and saving him lots of money. He can taste the grease, see it and smell it."

3. *Color*. It is tremendously surprising what dye or other color gadgets added to a lubricating grease can do for sales. A distinctive color or additive lends strength to the salesman's story about his grease being "different." It is quite possible for the consumer to be able to go up to the corner filling station and buy ordinary grease, but he certainly cannot buy your pink, or red, or green, or blue grease there. Your particular color identifies your product as much as, and sometimes more than, a lithographed container. You would be amazed if you fully realized the marketer's identification possible through the coloring of lubricating grease. A few years ago only an occasional specialty company dyed their greases as a sales aid. Today in our own plant we manufacture dozens of different colors of greases, ranging from pure white through hues of green, red, orange, blue, clear down to a yellow speckled lithium. The yellow speckle product we found later was due to a grease maker dropping a scrambled egg sandwich in the kettle and we were unable to duplicate the color on later batches. Seriously though, the addition of color has become extremely important and in my opinion the trend will continue toward more colored grease. So teach your salesmen to emphasize whatever difference your product has in color. It can be a definite sales advantage. It certainly takes the wind out of your competitor's "I can supply a grease just like it."

4. *Performance*. Here is a point that many a good salesman has used to take over an account from a competitor. The trend to multi-purpose greases in the past few years has become so great that it cannot even be called a trend any longer and must be accepted as an

Sure way to guard your greases against these 3 enemies:



Use a base of a

METASAP® ALUMINUM STEARATE

Metasap Stearates are known the world over as *the cleanest stearates made.*

Also, the Metasap technical staff is notably successful in supplying makers of greases with the exact properties they need for each specific task. There's a Metasap base which gives you a high gel type grease when *that's* what you need; another for a medium heavy gel where smoothness is your chief requisite; still another produces with great economy the semi-fluid, adhesive-type lubricant known as castor machine oil.

Each of these...and many more...and modifications of each to meet your most exacting needs, are at your service, together with the counsel of the most experienced stearate men in America.

Won't you call on them for their recommendations, soon?

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the cleanest stearates made

industry standard. Yet the consumer in the field still does not know what lithium means, what multi-purpose means, what advantages he can enjoy in the use of one grease and what wonderful quality he can have in a grease product. Each salesman should make it a point to carefully explain to each of his customers or prospects what a multi-purpose grease can be used for. Surely that is basic to us, but how about the fellow out in the field who doesn't know a thing in the world about grease? Forget drumming into your general run salesmen details about worked consistency, CRC wheel bearing tests, 10,000 strokes and shell roll. That means absolutely nothing to the consumer in 99 instances out of 100. What the consumer wants to hear is basic, "Mr. Jones, this will work in your wheel bearings and in your universal joints. You can put it in your water pump; you can grease your doors with it; you can put it on your hogs, on your harrow, your tractor, your springs, your pump handle, your garage door; in fact, Mr. Jones, you can just use this grease anywhere. That is what they mean when they say multi-purpose; it will work everywhere. It will do away with the cup grease you've got here and this old wheel bearing grease you can throw away. You don't need it any more." That's the kind of a story the consumer wants to hear and that's the only story which means a lot to him. I would bet that nine out of ten consumers now using a multi-purpose grease have no idea of the many uses that they can make of it. I have been in maintenance shops where drums of premium lithium were being used to lubricate chassis and next to those drums of premium lithium would sit a bucket or two of a soda wheel bearing grease which lacked a great deal of being as stable as the lithium. Lack of information on the consumer level had placed this maintenance supervisor in the position of over stocking of greases but would probably set him up for the next alert salesman who would inform him of the many multi-purpose facets of his particular grease.

5. *Protection.* Whenever you are talking about customer benefits one of the most overlooked angles to the sales story so far as grease is concerned is protection. Build into this presentation some solid facts about what sort of protection the consumer can expect and how long it will protect him. Protection selling is basic throughout our economic structure and yet you will find a mill-run salesman never thinks to make a little pitch on that vital subject. Teach your salesman to tell his prospects what a wonderful job of protection your product will do. This is the place where oxidation and rust inhibitors, etc., will fit into the sales story. It is certainly easy to point out how much cheaper it is to spend a few cents extra for a high quality lubricant which will protect equipment than it is to pay many hundreds of dollars for premature failures due to the use of poor and inadequate greases. This is a point well worth stressing and one that will bring concrete results in sales.

One more intangible point which needs covering is the necessity of convincing your salesmen they should not worry about what competition has got. He wouldn't care what kind of grease competition has if he is certain yours will do the best job for the consumer. The easiest way of covering this point is to spend your time building up the selling points in your own grease and forget that you even have competition out in the field. A weak salesman will spend most of his time trying to tell his superiors that the reason he can't sell is because competition has got "etc., etc., etc." If you refuse to discuss the merits of competition's grease and merely concentrate on pointing out your own features, your whole selling point will be easier to put over.

The foregoing has been an attempt to emphasize the importance of adequate *practical* training. I have tried to point out that adequate training can be gained without highly technical information and as a matter of fact, more basic, down-to-earth information is to be desired. Take the various points of appearance, consistency, color, performance and protection of your particular grease and work out a simple demonstration around those points and give that package to your consumer salesman. This positive product information on your own particular lubricant, when presented to the ultimate consumer in the field, will bring results. You won't have to worry about your motor oil or TBA sales, or your gasoline or diesel sales. Those products are going to go right along with that little old bucket of grease that the salesman made the prospect realize that he wanted to buy. Don't sell customer benefits—*Demonstrate* them.

About the Author

Charles E. Gore is sales manager of Battenfeld Grease & Oil Corporation. He is a graduate of the Marine Corps Institute, and completed an extensive tour of duty during World War II and then entered the automotive parts field as a salesman. He rapidly became a top volume producer and was brought into the office as sales supervisor. Gore then joined a national retail marketing organization to become sales manager in the retail division. Several years ago he joined Battenfeld and after an extensive training program was appointed southern sales representative, and then sales manager.

Features Are Welcome

More and more technical and marketing articles are being received in the national office—these features are always welcome. After review and approval by the marketing or technical editorial committees the material is sceduled for an early appearance in the NLGI SPOKESMAN. Authors should forward all manuscripts and illustrations to NLGI in Kansas City.

More Coordination

Greater liaison between NLGI and other societies with similar problems is becoming a reality as T. G. Roehner, technical committee chairman, met with SAE's fuels and lubricants executive committee during the January SAE annual meeting. J. W. Lane, NLGI president, will chairman the technical session on Monday afternoon, April 15, at the ASLE annual meeting.

More About Wheel Bearings

API's lubrication committee is preparing a course of instruction in automotive lubrication . . . the plan is to make the course available nationally after a thorough tryout by New York City schools. Accompanying the course will be a slide film illustrating the text, with special emphasis on wheel bearing lubrication . . . the illustrations to be taken from NLGI's "Recommended Practices for Lubricating Automotive Front Wheel Bearings." Full credit to the Institute will be given for the illustrations.

Annual Audit

The annual audit of the NLGI national office and the treasurer's office began shortly after the first of the year, necessitating the usual checking procedures against invoices and billing . . . all to insure a businesslike operation.

Attention on Grease

The October-November issue of *DuPont Magazine* featured the Hulburt company's greases . . . this NLGI Active member uses an estersil supplied by DuPont, an NLGI Associate member. The Institute's representative and Hulburt's general manager, David Michael, was pictured in an illustration accompanying a case history about Hulburt products in coal mining operations.

NLGI 1957 Liaison Committee

Society of Automotive Engineers	F. E. Rosenstiehl
American Society for Testing Materials	G. E. Merkle
American Standards Association	H. L. Hemmingway
American Society of Lubrication Engineers	B. G. Symon
American Society of Mechanical Engineers	W. H. Saunders, Jr

SERVICE AIDS OFFERED BY NLGI

- **BONER'S BOOK — Manufacture and Application of Lubricating Greases, by C. J. Boner. This giant, 982-page book with 23 chapters dealing with every phase of lubricating greases is a must for everyone who uses, manufactures or sells grease lubricants. A great deal of practical value. $18.50, prepaid.**
- **WHEEL BEARING MANUAL—"Recommended Practices for Lubricating Automotive Front Wheel Bearings." More than 90,000 copies of this booklet have been distributed throughout the world. Just fifteen cents a copy with quantity discounts—company imprint can be arranged.**
- **NLGI SPOKESMAN — Bound Volume XIX, covering past issues from April, 1955 through March, 1956. An excellent reference source, sturdily bound in a handsome green cover. $7.00 each, plus postage.**
- **NLGI FILM — Grease, the Magic Film, a 16-mm sound movie in color running about 25 minutes, to be released early in 1957. Institute sponsored at a cost of $30,000, individual prints may be ordered now for $800.**

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4638 J. C. Nichols Pkwy.
Kansas City 12, Mo.

Patents and Developments

Wear Inhibiting Greases

It is well known that chemical and mechanical wear is one of the most aggravating problems in the field of lubrication. From a practical point of view, wear may be considered as being of probably greatest importance in lubrication, since the removal of metal necessitates replacement of parts. Although mechanical or abrasive wear, due to contacting of surfaces, is the most damaging, considerable amount of wear is also due to chemical (corrosive) action or due to a combination of chemical and abrasive wear. These wear conditions are encountered in all types of engines and machines operating with all types of fuels, particularly high-sulfur fuels and under various conditions.

Because of the complexity of the problem, it is difficult to predict that a class of compounds, such as organic compounds containing phosphorus, halogen and/or sulfur (which compounds generally possess extreme pressure and friction reducing properties) would also possess anti-wear properties. Experience and accummulated knowledge in this field indicates that such might not be the case and that compounds possessing extreme pressure and friction reducing properties might be poor in preventing wear.

In U.S. Patent 2,748,082, use is made of oil-soluble petroleum sulfonamides, preferably N-substituted sulfonamides derived from petroleum fractions rich in aromatics.

Various methods and processes may be employed in converting the petroleum fractions to the sulfonamides such as described in U.S. Patent 2,334,186. Among the preferred amines which can be used for converting petroleum fractions from their petroleum sulfonyl chlorides or flourides state into corresponding petroleum sulfonamides of the patent include ammonia, ammonium hydroxide, primary and secondary aliphatic amines, such as butyl, tertiarybutyl, isoamyl, 2-ethylhexyl, octyl, dodecyl, octadecyl, oleyl, stearylamines; methyl octyl, methyl dodecyl amines, etc.

Specific examples of sulfonamides of this patent include:

Petroleum [a] sulfonamide
N-octadecyl petroleum [a] sulfonamide
N-2-ethyl hexyl petroleum [a] sulfonamide
N-methyl, N-octyl petroleum [b] sulfonamide
N-oleyl petroleum [b] sulfonamide

[a]Petroleum used was California motor raffinate 400/100 SUS, 19% aromatics.
[b]Petroleum used was West Texas Ellenburger 250 N, 30% aromatics.

An example given is a blend of petroleum sulfona-

mide (to the extent of 0.2% N) in a lithium base grease.

Polyamide-Polyamate-Thickened Grease

It is becoming more and more apparent that, for the most part, greases must be able to lubricate effectively at high temperatures, that is, temperatures in the range of 350°F. to 500°F., preferably above 400°F. Numerous grease specifications of government agencies and industry now specify grease compositions having minimum dropping points of 400°F. This need for high temperature greases is the result of increased driving power, which increases the speeds of gears, bearings, and other moving parts; increased pressures caused by the development of smaller gears to withstand greater loads than heretofore possible with large gears, etc.

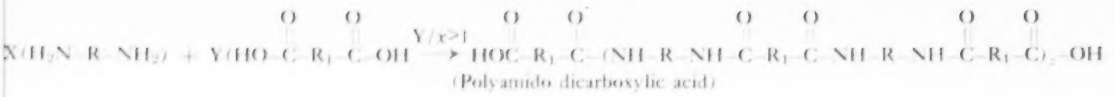
Greases prepared according to U.S. Patent 2,752,312, issued to California Research Corporation are claimed to maintain grease consistencies at extremely high temperatures; that is, such greases will remain unctuous and not become hard or brittle at temperatures in the range of 350°F. to 500°F.

In the automotive industry, for example, there is the constant desire to manufacture smaller internal combustion engines without sacrificing power output. In fact, many of these smaller engines are designed to deliver greater power than their larger counterparts. The same smaller engines have considerably less bearing surfaces than larger predecessors, which means that bearings bear greater loads than before.

Similarly, the continuing trend to manufacture automobiles with lower centers of gravity has made it necessary to use smaller driving gears, particularly in such gear assemblies as the differentials and transmissions. The smaller gears thus used have considerably greater pressures exerted upon them per unit than gears of older type gear assemblies. The higher loads on bearings and gears demand better thickening agents in grease compositions.

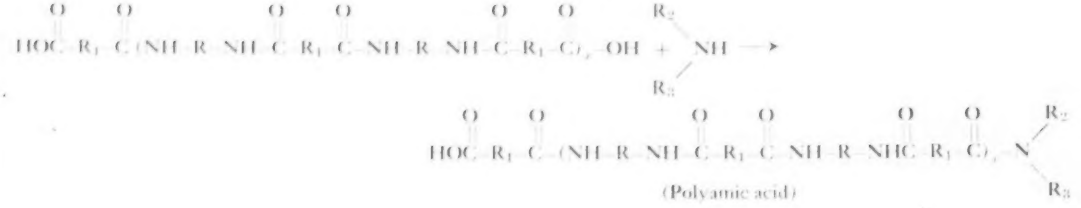
According to the patent, lubricating oils are thickened to the consistency of greases by incorporating certain polyamides therein. These polyamides are prepared by first reacting a dicarboxylic acid with a diamine, wherein the molar ratio of dicarboxylic acid to amine is greater than 1. The resulting polyamido dicarboxylic acid is then further treated with a primary or secondary amine (or mixtures thereof) in an amount less than that necessary to neutralize all of the carboxyl groups, forming polyamic acids. The polyamic acids are then reacted with a metal oxide or hydroxide to neutralize the carboxyl group of the polyamic acid. The polyamic acid metal salt, then, is used to thicken lubricating oils to the consistency of a

EQUATION 1



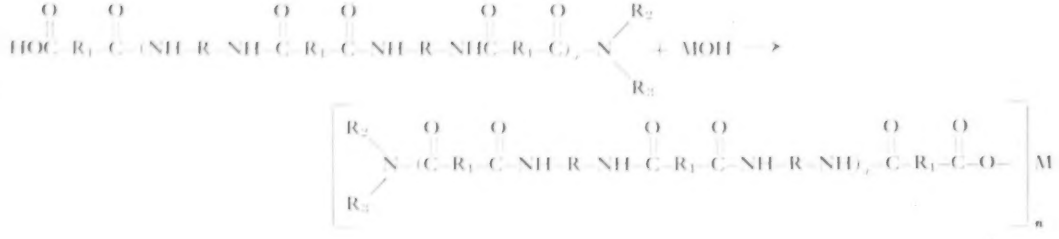
(Polyamido dicarboxylic acid)

EQUATION 2



(Polyamic acid)

EQUATION 3

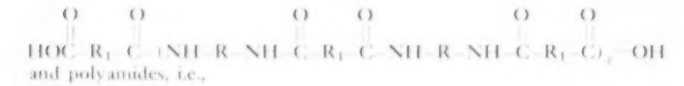


grease according to the patent.

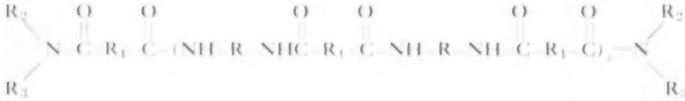
The reactions involved in the preparation of this thickening agent are exemplified in equations one, two and three.

As stated above, less than stoichiometric amounts of amines are reacted with the polyamide dicarboxylic acids, leaving free carboxyl groups. Although the amount of amines used be sufficient to neutralize from 10% to 95% of the terminal carboxyl groups, it is preferred to use amines in amount sufficient to neutralize from 50% to 90% of the terminal carboxyl groups, leaving from 90% to 50% (10% to 50% preferred) carboxyl groups free for saponification by reaction with a metal oxide or hydroxide.

It is recognized that in the formation of the above polyamic acids and salts thereof that polyamido dicarboxylic acids and the salts thereof, i.e.,



and polyamides, i.e.,



are also found. It is preferred that the amount of polyamido dicarboxylic acids and salts thereof be kept at a minimum.

The polyamic acids of themselves can thicken lubricating oils to the consistency of greases, and can be considered as grease-thickening agents.

In the above formulas R, R_1, and R_2 are saturated or unsaturated, straight-chained, branch-chained or cylic, essentially hydrocarbonaceous groups, R_3 is hydrogen or a saturated or unsaturated, straight-chained or cyclic essentially hydrocarbonaceous group, Y/x is the molar ratio of dibasic acid to diamine, which ratio has a value greater than 1 (i. e., from 1.05 to 5.0; preferably from 1.4 to 4); and M is a metal from groups I, II, III and IV of Mendeleef's Periodic Table, such as sodium, potassium, lithium, calcium, barium, zinc, aluminum, silver, lead, magnesium, etc.

The R and R_1 can be methylene groups, i. e., $(CH_2)_x$, wherein x is a number for the R group, from 2 to 30 (4 to 8 preferred), and for the R_1 group, from 1 to 52 (2 to 8 preferred) (including methylene groups which have one or more saturated or unsaturated, straight-chained, branch-chained or cyclic groups attached thereto); a phenyl group; a substituted phenyl group, wherein the phenyl nucleus contains one or more aliphatic groups attached thereto, etc.

The R_2 and R_3 groups (when R_3 is not hydrogen) can be aliphatic groups, alkaryl groups or aralkyl

groups, each having from 2 to 50 carbon atoms, 4 to 20 carbon atoms being preferred.

Examples of R and R_1 groups include methylene, dimethylene, trimethylene, hexamethylene, octamethylene, octadecylmethylene, a benzene nucleus, a substituted benzene group (wherein the benzene nuclus has one or more aliphatic groups attached thereto), etc.; radicals derived from petroleum hydrocarbons, such as white oil, wax, olefin polymers, etc.

Examples of the R_2 and R_3 radicals (when R_3 is not hydrogen) include the following: ethyl, propyl, propenyl, butyl, pentyl, pentenyl, hexyl, octanyl, monyl, decyl, decanyl, dodecyl, dodecenyl, tetradecyl, tetradecenyl, hexadecyl, octadecyl, eicosyl, triacontyl, capryl, octadecenyl, radicals derived from petroleum hydrocarbons, such as white, oil, wax, olefin polymers, e.g., polypropylene and polybutene, etc.

By "the essentially hydrocarbonaceous" radical, is meant those radicals which are composed mainly of hydrogen and carbon, and include such radicals which include, in addition, minor amounts of the substitutes such as chlorine, bromine, oxygen, nitrogen, etc.

As is well known in the art, it is characteristic of bifunctional reactants similar to the diamines and the dibasic acids herein that the possibility exists of producing polymers of infinite length. However, the maximum length of the diamine-dibasic acid polymer formed according to this patent is not as great as that obtained wherein the diamines and the dibasic acids are present in stoichiometric amounts. It is known that when the value of Y/x in the above equation is 1, the resulting diamine-dibasic acid reaction products are not oil dispersible. However, when the value for Y/x is less than 1, the resulting polymeric compounds are oil dispersible.

The values of z in the above equation are not fixed values for any one reaction. It is understandable to those skilled in the art that, although z is an integer, it varies considerably. For example, in the formation of thickening agents of this invention wherein adipic acid and hexamethylene diamine are the reactants and the value for Y/x is less than 1, the value of z can vary from zero to 10 or more for the individual reaction products formed. However, the "average" value for z in such an example varies only from about 1.5 to about 4. In all probability, z can vary from 0 to 20 or more.

The following is an example of the preparation of a suitable polyamic acid soap grease:

A mixture of 72.5 g. (0.5 mol) hexamethylene diamine (80% solution in water) and 146 g. (1 mol) of adipic acid was slowly heated with stirring. Water of reaction began to come from the reaction mixture

at 240°F. 20 minutes later the temperature had reached 420°F., a which temperature the water of reaction ceased. To this reaction mixture 233 g. (0.75 mol) of Armeen HT was added dropwise at temperatures ranging from 390-430°F. over a period of 15 minutes. The reaction mixture was heated for an additional 5 minutes at 420-440°F. The cooled reaction product was a yellow-tan solid.

24 g. of the above reaction mixture (a tan solid) and 176 g. of a California solvent-refined naphthenic base oil having a viscosity of 450 SSU at 100°F., were heated, with stirring, to 450°F. This mixture was cooled to 200°F., and an aqueous solution of $LiOH\text{-}H_2O$, heated to 450°F., then cooled to room temperature and milled through a 200-mesh screen. The resulting grease had a dropping point of 445°F., and an ASTM worked penetration of 223 (60 strokes).

Lithium Soaps

Numerous attempts have heretofore been made to react lithium carbonate with acidogenic materials, particularly fatty materials such as fatty acids, but in all such attempts the proportion of soap produced was minute in proportion to the amount of ingredients used, resulting in less than 1% of the lithium carbonate being used in the reaction.

According to U. S. Patent 2,753,364 issued to Battenfeld Grease & Oil Corporation, lithium carbonate can be caused to react completely with acidogenic materials if there is present a small proportion of another basic material which can afterwards be volatilized. This basic material is preferably ammonia, an ammonia-producing compound, or an ammonia solution, although substances which react with acidogenic materials to give ammonium type compounds or decomposed through the action of heat, water or any other agent to produce substances which react with acidogenic materials to give ammonium type compounds such as carbonates of ammonia, amides of carbonia acid, urea, guanidine carbonate, primary, secondary and tertiary alkyl amines such as monoethanolamine, diethanolamine and triethanolamine respectively, primary and secondary alicyclic amines such as cyclohexylamine and dicyclohexylamine respectively, heterocyclic amines such as pyridine, primary and secondary aryl amines such as aniline and diphenylamine respectively, acid amides such as acetamide, and acid nitrates such as acetonitrile, benzonitrile, and benzyl cyanide, have been proved satisfactory.

The fatty acids found to be most effective are monocarboxylic acids such as hydroxystearic, stearic, oleic, palmitic, or various mixtures of the same, although combinations with other fatty acids both natural and synthetic may be of value. Such fatty acids may be derived from animal, marine or vegetable oils or fats or waxes or their hydrogenated products. Either pure or substantially pure stearic acid or commercial stearic acid containing varying proportions of oleic, palmitic and stearic acids may be used. Also of value for production of lithium soaps are any aromatic, acidic materials such as naphthenic acids, sulfonic acids, benzoic acids, phenylacetic acids and ethyl-hexoic acids. Further illustrations include acrylic acid, crotonic acid and cyclohexyl acetic acid.

As is well known in the industry, there are two basic types of metallic soaps, the precipitated and the fused. Lithium carbonate soap can result from either of the two methods. However, the precipitation method as described in this patent, is a modification of the true precipitation method in that water is used for a purpose other than that for which it is ordinarily employed.

The procedure to be followed in bringing together the various ingredients may vary, but in the case of the modified precipitation soap method, a fundamental procedure will be outlined first with the variations following.

It has been found that .001-1.0 gram molecular weight of ammonia, calculated as NH_3, is sufficient to complete the saponification of one gram molecular weight of lithium carbonate with two gram molecular weights of a fatty acid, or its equivalent of mixed fatty acids, provided some of the ammonia remains in the reaction mass until saponification is completed. In order to insure that the ammonia is retained in the mass, sufficient water to form from 1.0-0.1% solution of ammonia has been found to be satisfactory. However, the amount of ammonia to be used, and as specified above, is not necessarily critical in that any amount of ammonia above the amount mentioned will react properly and the reaction will be complete.

Subsequent to saponification, the ammonia is driven off by a suitable form of heat. However, in order to volatilize the ammonia before the reaction and saponification is complete, it is preferable to conduct the saponification within a range just above the softening point of the fatty acids. The softening point of the fatty acids, as is well known, is just slightly above their individual titer. For example, in a fatty acid such as commercial stearic acid, the titer or softening point is 58°C. The higher the titer, the higher the softening point; the lower the titer, the less the heat requirements to obtain the softening point.

In practicing this procedure, use of slightly less than the molar proportion of lithium carbonate is preferred when starting the reaction. After the lithium carbonate and fatty acid have completely reacted, a sufficient amount of a solution of lithium hydroxide is utilized to form a neutral soap. It is notable that lithium hydroxide is used for no other purpose than to bring the soap to the neutral point. In some cases, it has been found advantageous to finish the soap with a slight excess of acid, and in such cases, the lithium carbonate alone is used.

After saponification is complete, the mass is dehydrated, either in the presence of an oleaginous material, or without, depending of course, on whether a grease or oil is being made, or whether only a soap is to be produced which will later be compounded into other products. The oleaginous material may include any lubricating fluid such as mineral oil, which when thickened with the soap, will form lubricating oils or greases. Such lubricating fluids may include esters, both natural and synthetic, polymers and resinous materials, as well as synthetic diesters such as di-2-ethyl hexyl sebacate, and polymers such as silicone fluids or polymerized olefins.

An important fact to note is that the lubricating fluid used to make the grease or lubricant, can be added at any time during the reaction period, i. e. at the very beginning as above specified, or preferably, later in the process. Also, the nature of the end product wherein a grease or lubricant is desired, depends on the type and amount of lubricating fluid employed. Manifestly, therefore, any oleaginous material is suitable, enabling the compounder to tailor-make any grade grease or lubricant desired.

The formation of lithium soap by this particular process may take place in an autoclave under pressure, but the open kettle method of saponification has the advantage that it permits the escape of carbon dioxide as the reaction proceeds to completion.

What the reaction is and through what steps it proceeds is not perfectly understood, but it is the belief that ammonia soap is first formed with the fatty acid. The lithium carbonate and the ammonia soap then enter into a double decomposition reaction which results in the formation of a lithium soap. Although it is believed that all of the ammonia soap is decomposed, traces may remain in the finished product.

After saponification is complete, the mass is dehydrated. If the soap is to be employed as a base for a lubricating grease, this dehydration may take place in the absence of or in the presence of a portion of the mineral oil to be employed in the finished product. The higher temperatures that are applied when the mineral oil is in the mass, has two purposes. One purpose is to drive off the ammonia that remains in the grease, as well as to vaporize the water that has been used and expell it also from the mass. The second purpose is to obtain a complete dispersion of the soap in the mineral oil. When the water and ammonia have been completely driven from the mass and the soap

is thoroughly dispersed, heating is discontinued and the end product is permitted to cool naturally for approximately 24 hour or the mass may be cooled in a static state or while being subjected to agitation. In both instances however, a gel stage has to be obtained before the actual end product is ready for commercial use and application.

The following is an example of the modified precipitation soap method employed:

The following ingredients are mixed together and stirred:

50 ml. of water
2.0 grams of 28% aqua ammonia
40 grams of lithium carbonate of 98.5% purity

To this mixture, 300 grams of powdered stearic acid of 58°C. titer is added and mixing continued. The stirring of the original ingredients is not critical, but is continued until a thorough mixture is obtained. The same is true after the stearic acid is added, but in the latter instance, stirring is continued until the lithium carbonate has reacted. Heat is applied to the mass until its temperature reaches 150°F. Thereafter, heat is applied from time to time as required in order to maintain the mass at 150°F. The mass is stirred continuously and maintained at this temperature for one and one-half hours when a titration shows 0.2% of free stearic acid. At this point, 150 grams of a mineral oil of 400 SUS. at 100°F. are added and heating resumed until the mass reaches 300°F. As previously stated, the type and viscosity of the mineral oil is not important since the particular mineral oil determines only the characteristics of the end product. Also, heating of the mass to 300°F. drives off the major portion of ammonia and water.

Further addition of mineral oil is made with continued heating until a total of 2100 grams of the oil have been added. Heat is continued until the mass reaches 400°F. This last specified temperature is obtained as stated previously, to drive off the remainder of the ammonia and water, if any remain, and also to thoroughly mix the soap and oil. The mass is permitted to cool approximately 24 hours, the gel stage having passed before the end of such period of time. The lubricating grease of this example has an ASTM worked consistency at 77°F. of 275 and a dropping point of 361°F.

Lubricating Grease of Synthetic Oil and a Complex Thickener

In the prior art various attempts have been made to formulate lubricating grease compositions of improved high temperature performance characteristics. Various types of mineral oils and synthetic oils have been combined with various thickeners. As a general rule, prior art lubricating greases have been made by adding thickeners to hydrocarbon oils or mineral base oils. The thickeners have usually consisted of the fatty acid soaps of the alkali and alkaline earth metals, though some non-soap thickeners have been used. Some improvements in the thickeners have been made by incorporating low molecular weight salts or other modifiers into the soaps. Thus salts of acetic, acrylic, and other acids have been used. These low molecular weight constituents, when combined with the common fatty acid soaps of high molecular weight, have shown definite advantages in some cases in raising the dropping point or in stabilizing the grease against oil separation in moderately high temperature service.

Recently, the development of jet engines and turbojet for aircraft has accentuated the need for lubricants useful for service at still higher temperatures. Certain new types of synthetic oils have been proposed as lubricants in such engines.

Many of the synthetic oils such as dibasic acid esters, complex esters, e. g., of polybasic acids and glycols or polyglycols, and the like, cannot be thickened very satisfactorily with conventional soaps in the same manner as mineral oils. Some simple esters have been thickened to grease consistency with certain special soaps, e. g., lithium stearate, but the use of synthetic oil base greases has been very limited notwithstanding the very good lubricating properties which some of the synthetic materials, especially complex synthetic esters possess.

In U. S. Patent 2,750,341 issued to Esso Research & Engineering Company, there is disclosed the discovery that certain complex soap-salt thickeners, e. g. a fatty acid soap and low molecular weight organic salt complex of lithium has outstanding properties as a thickener for some of the new types of synthetic materials which have been very difficult in the past to convert to lubricating greases.

Another aspect of the patent is the discovery of a grease composition of exceptional stability and fine lubricating properties at high temperatures composed primarily of a complex type aliphatic ester thickened to grease consistency with a lithium soap-salt complex of the type mentioned above. The complex ester mentioned is preferably of the type prepared by esterifying dibasic acids and dihydric alcohols, adding a monovalent substituent to complete the esterification. One type of such lubricant is prepared by esterifying a glycol or a thioglycol with adipic acid or sebacic acid or one of their homologues or thio equivalents, to produce an ester having, for example, a dihydric alcohol residue at the center and two dibasic acid residues attached, one on either side of the center. The end groups of the acid residues are esterfied with a monohydric alcohol. Alternatively, a dibasic acid center may be esterified with two mols of dihydric alcohol which, in turn, have their esterification completed by treatment with two mols of monobasic acid. The expression "complex ester of dihydric alcohol and dibasic acid" refers to either of these types.

The conversion of lubricating oils to greases by additions of a thickener is frequently a difficult matter.

Most mineral base oils can be converted to greases by adding sodium or calcium soaps of the higher saturated fatty acids, e.g. sodium, stearate, calcium stearate, etc. For the simple synthetic ester oils, such as di-2-ethyl hexyl sebacate, for example, dry lithium stearate, previously prepared, is a reasonably good thickener, forming a grease having good lubricating qualities over a wide temperature range. In some oils, however, including some of the higher viscosity index types of mineral oils, even these soaps do not form stable colloids or greases. These properties depend somewhat on the solubility of the soap in the oil.

Simple soaps, e.g. the sodium or calcium soaps of C_{12} to C_{22} fatty acids, are entirely too soluble in the complex esters described above to make a good grease structure. Furthermore, they cannot be prepared in situ in such esters because the basic saponfying agent, e.g. metal oxide, hydroxide or carbonate, hydrolyzes or decomposes the ester.

In the prior art, it has been suggested that greases employing synthetic ester oils may be made by forming a soap in a small quantity of mineral oil and thereafter blending in the ester, e.g. di-2-ethyl hexyl sebacate, or dialkyl esters of adipic acid, etc. This technique apparently can be employed with many of the esters where the soaps used are not too soluble, but even in these cases the superior viscosity index and high flash point or low volatility characteristics of the synthetic oil are at least partially lost. With complex esters of the type mentioned above, where these properties are very important, mineral oil dilution is most objectionable, aside from the fact that simple soaps are not effective thickeners.

According to the present patent, a complex ester as described above may be thickened by the use of 5 to 25% by weight, based on the total composition, of the complex soap thickener. This complex thickener may consist of various soaps, a preferred material being about 0.5 to 2 mols lithium soap of fatty acid in the C_{12} to C_{22} range, combined with about 1 mol of the lithium soap of a lower carboxylic acid, i.e, having a molecular weight below about 100. The low molecular weight salt is preferably the acetate, but may be a propionate or formate, or it may be an unsaturated material of similar molecular weight range such as an acrylate, methacrylate or crotonate. The formates are difficult to disperse and higher acids than the propionate do not form good complexes. The saturated materials are preferred for the long chain fatty acids. For the low molecular weight acids, either saturated

or unsaturated are about equally desirable. The most suitable fatty acids are of about C_{18} average chain length. The acetate or acrylate (the lower molecular weight salts) are preferred for the low molecular weight component of the "complex" which appears to be of the Werner type.

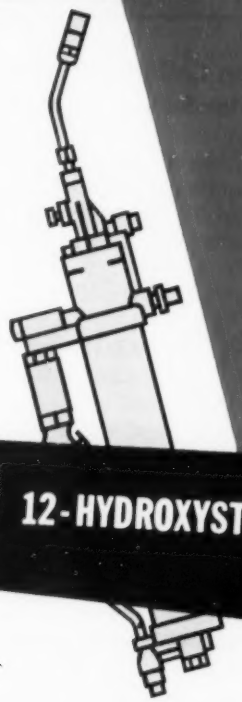
The specific preferred thickener for the complex ester greases is composed approximately of one mol of the lithium soap of fatty acids of approximately the stearic acid chain length (C_{18}) in combination with about one mol of lithium acetate. Instead of straight stearic acid, the fatty acids resulting from the hydrogenation of fish oils, e.g. "Hydrofol Acids 54" are very satisfactory for making the soaps. These average about C_{18}, though they may range from C_{12} to C_{22}. The quantity of soap complex required may vary somewhat depending upon the desired consistency of the grease. Preferred proportions are usually from 10 to 20% and for an average grease composition of general utility, about 15% of the complex is quite satisfactory.

Instead of using the straight complex ester as the oily constituent, a silicone oil of lubricating grade may be blended in to replace a part of the ester. This is of advantage where very high temperature stability is requisite. The silicones, such as dimethyl silicone polymer, do not appear to be as good in lubricating properties as the complex esters but they do have excellent high temperature stability. A very satisfactory grease has been prepared using about half and half of the complex ester and silicone.

In order to prevent hydrolysis of the ester, it is necessary to form the soap-salt complex separately. While this could be done in mineral oil, as noted above, the product of the present invention is best made by using a dry preformed soap complex. The latter is prepared by direct neutralization of a mixture of the fatty acid (stearic acid or hydrogenated fish oil acids) and low molecular weight acid (preferably acetic acid) with the base in an aqueous medium. Alkali metal bases are preferred, lithium being preferred and sodium next. Ordinarily the hydroxides are employed. Proportions of base should be sufficient to neutralize the high and low molecular weight acids without substantial excess or deficiency, although a minor degree of free acidity or alkalinity may be tolerated.

Alternatively, the acetate, or other low molecular weight salt, and the soap may be formed separately, dried and ground into fine powders, and the powdered materials mixed together before adding to the synthetic oil. A soap-salt complex apparently is formed, much as in the procedure described.

Baker



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Saponification Value	180.	188.	180.
Hydroxyl Value	160.	154.	171.
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Loss of Hydroxyl Value (6 hrs. at 285° F)	NEGLIGIBLE	27%	NEGLIGIBLE

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PEOPLE in the Industry

Fiske Bros. Refining Elects G. E. Merkle President of the Firm

The board of directors of Fiske Brothers Refining Company have elected Mr. George E. Merkle as president, succeeding the late Mr. Frederick J. Snyder.

Mr. Merkle was first employed as chief chemist in the company's laboratory. In 1926 he was appointed technical director and in 1929 was made plant manager. In 1937 he was appointed general manager of the company's operations. He was elected vice president in 1941 and executive vice president in 1953.

Has Authored Technical Books

Mr. Merkle is the co-author of two technical books and author of some technical publications. He also holds patents on lubricant compositions. He was graduated from the University of Massachusetts and did his post graduate work for a Ph.D degree at Rhode Island State College.

A member of the board of the National Lubricating Grease Institute since 1948, Merkle served as NLGI president in 1951-1952.

McDougal is Cooperative GLF Division Supervisor

Petroleum division of Cooperative G.L.F. Exchange, Inc., has announced the appointment of Gerald A. McDougal as personnel supervisor, effective January 2.

The former district manager replaces H. Ellis Ross, now division sales-service supervisor, according to division manager Ronald B. Fitch.

McDougal joined G.L.F. in 1937 at the Ithaca bulk plant, was later manager of the plant at Guilderland Center, N. Y., and district manager in New Jersey. As district manager in northern New York, he supervised operations of eleven petroleum bulk plants operated by the farmer cooperative.

Acheson Colloids Appoints Rochester Service Engineer

William D. Signer, Jr. has been appointed service engineer at the Rochester offices of Acheson Colloids company, located at 662 Monroe Avenue, Rochester 7, New York. He will serve western and central New York state and Erie county, Pennsylvania.

Mr. Signer studied mechanical engineering at Rochester Institute of Technology and did extension work at the University of Rochester. Prior to joining Acheson, Mr. Signer worked in the metallurgy department of Commercial Controls company and was a sales engineer with Taylor Instrument companies, both of Rochester.

Socony's Holaday To Defense Post

William M. Holaday, formerly head of the research and development activities of Socony Mobil Oil Company, Inc., is leaving the company effective Feb. 1, 1957, to become Deputy Assistant Secretary of Defense (Research and Development). Mr. Holaday has been on leave of absence from the company since Feb. 1, 1956, serving in this capacity, with headquarters in Washington, D. C.

Hinyard Directs Market Development for American Potash

James N. Hinyard has been appointed director of market development for American Potash & Chemical Corporation, according to an announcement by Daniel S. Dinsmoor, AP&CC vice president in charge of planning and development.

Hinyard replaces Dr. A. J. Dirksen who recently was named general sales manager of the company's industrial chemicals division. He will make his office at AP&CC headquarters at Los Angeles.

Hinyard, who holds B.S. and M.S. degrees in chemical engineering from the University of Texas, at Austin, formerly was with Merck & Company, Inc., at Rahway, N. J., where he was responsible for market research and development of new and existing products.

Williams Joins Emery Sales Force

George R. Williams has been appointed sales representative in the New York City area, R. F. Brown, sales manager of the organic chemical sales department of Emery Industries, Inc., Cincinnati, announced.

Under the direction of J. W. Ritz, eastern district manager, Williams will handle Emery's line of organic chemicals, including dibasic acids, polymerized acids, plasticizers, fatty esters, lubricant esters, textile finishing oils and softeners.

Williams holds the degrees of B. S. in physical science from the University of Chicago, and B. S. in chemical engineering from the University of Wisconsin. Prior to joining Emery, he was the Cincinnati area salesman for Merck & Company, Inc. He is affiliated with Alpha Chi Sigma.

Mallinckrodt Names Bradshaw General Purchasing Agent

The appointment of Mr. G. C. Bradshaw as general purchasing agent of Mallinckrodt Chemical Works, St. Louis, has been announced by Mr. Joseph Fistere, president of the company. Mr. Bradshaw succeeds Mr. Erwin H. Doht, who died suddenly November 25, 1956.

Mr. Bradshaw has been with Mallinckrodt since 1925 and was sales manager of the company's western division from 1947 until 1954, at which time he was made director of sales research.

Mr. Bradshaw is a member of the Sales Managers' bureau and the Associated Drug and Chemical industry of Missouri.

Valvoline Conducts West Coast Sales Meetings

A series of five Valvoline Oil company sales meetings have recently been completed for their Pacific Coast divisions.

Harold Dunmire, vice-president in charge of bulk sales, and Ro Sailer, technical director, conducted the meetings at Valvoline branch offices in Los Angeles, California; San Francisco, California; Portland. Oregon; Seattle, Washington; and Vancouver, Canada.

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Lithium Promotes Six Executives

The apointment of four new vice presidents and the elevation of two to the newly created position of senior vice president, was announced by Herbert W. Rogers, president of the Lithium Corporation of America.

Named vice presidents, effective January 1, were: Dr. R. B. Ellestad, director of research; Walter M. Fenton, director of product research and development; J. Dean Herman, director of chemical plant operations, and J. D. Campbell, director of sales.

Willis W. Osborne, treasurer, and Fremont F. Clarke, general manager of operations, the company's two vice presidents, were appointed senior vice presidents.

Dr. Ellestad, who earned his Ph.D. at the University of Minnesota, has been director of research for Lithium since 1942. Prior to that he taught at Harvard, Tufts, and the University of Minnesota. He is a member of the American Chemical Society, the Geochemical Society and a fellow in the Mineralogical Society of America.

Fenton in Charge of Research

Fenton, sales manager from 1943-55, will be vice president in charge of product research and development. He is a member of the American Chemical Society, Federation of Engineering Societies and the American Ceramic Society.

Herman, with Lithium since 1943, becomes vice president and director of chemical plant operations. He was previously in charge of construction of the company's chemical plant in Bessemer City, North Carolina, and plant manager of the St. Louis Park plant. Herman, a graduate of the University of Minnesota, with a BS in Chemical Engineering, is a member of the Electro-Chemical Society, Sigma Chi, and the Masonic Lodge.

Campbell Is Sales Manager

J. Douglas Campbell, vice president and sales manager, attended Columbia University, New York City. He joined Lithium in 1947 as sales representative in New York, after having previously served as sales manager of Metal Hydrides, Inc., and Lithaloys corporation.

"This announcement gives me great pleasure," said Rogers. "It is not only recognition of men who have been instrumental in the growth of Lithium Corporation, but the added responsibilities they undertake helps prepare our organization for the expansion which we look forward to in 1957."

Industry NEWS

Kerr-McGee Acquires Cato Oil and Grease Co.

Acquisition of all the capital stock of the Cato Oil and Grease company of Oklahoma City was announced by Kerr-McGee Oil Industries, Inc.

Cato will continue to operate as an individual company, marketing oils and greases under its Pentroleum, Wanda, and other trade names. The company operates a grease manufacturing and oil compounding plant at 1808 NE Ninth in Oklahoma City, and employs 110 persons.

Cato's Officers are Retained

Officers and employees of Cato will remain unchanged in their duties. C. C. Huffman is president; Leon M. Oswalt, vice president, manufacturing; Howard D. Wixon, Jr., vice president, sales; and Ralph Jenks, secretary-treasurer. A member of the National Lubricating Grease Institute, Cato's company representative is C. C. Huffman, and W. J. Ewbank is the technical representative.

D. A. McGee, president of Kerr-McGee, said purchase of Cato is a further step in the company's integration.

Alpha Molykote Readies Dry Film Lubricant

Molykote, Type 174X, a new dry film lubricant formulated especially for drawing and forming of titanium, titanium alloys, chromium and stainless steels at elevated temperatures, is announced by the Alpha Molykote Corporation, Stamford, Conn.

The newly-developed lubricant consists of extremely fine particle size graphite combined with a high temperature binder and dispersed in an aromatic solvent system. It has been used successfully for drawing and forming at 600°F to 1400°F and can be applied by spray or brush.

For detailed information on Molykote 174X, write to The Alpha Molykote Corporation, 65 Harvard Avenue, Stamford, Conn.

Climax Publishes Molybdenum Disulfide Bulletin

A new two-page bulletin "Properties of Molybenum Disulfide," has just been issued by Climax Molybdenum company, Dept. L, 500 Fifth Avenue, New York 36, N. Y., and is available on request.

Designated Bulletin Cdb-5 in the Climax chemical data series, the publication covers the physical properties, thermodynamic properties, electrical and magnetic properties, chemical properties, preparation and uses of molybdenum disulfide (MoS_2). A blue-gray to black solid, molybdenum disulfide occurs naturally in molybdenum and copper ores, and can be prepared synthetically. The chemical and physical properties given in the bulletin are those reported for the natural material, which differs substantially in crystal structure from synthetic molybdenum disulfide.

Stauffer Absorbs Nyotex And New York-Ohio Chemicals

To simplify and strengthen its organizational structure, Stauffer Chemical company has integrated two former subsidiaries, Nyotex Chemicals, Inc. and New York-Ohio Chemical corporation, into the parent corporation. The former will be operated as Nyotex Chemicals division of Stauffer Chemical

company, and the latter has now been made a part of the company's Industrial Chemicals division.

Nyotex has its main facilities at Houston, Texas and produces anhydrous hydrogen fluoride and aluminum chloride. New York-Ohio plants are located at Niagara Falls, N. Y., Elkton, Md., and Dominguez, Calif., manufacturing aluminum chloride, antimony trichloride and anhydrous hydrogen chloride.

Sales of all these products will be handled nationally by Stauffer's industrial chemicals division.

Improved Triplex Pump Fits Service Conditions

A research and engineering group attached to the Votator division of the Girdler company, Louisville, Ky., has designed a sanitary triplex pump with basic improvements that solve many problems in the food and chemical fields. It is compact and trouble-free. Girdler is a division of National Cylinder Gas company, Chicago.

The new pump is employed where corrosive slurries of viscosities as high as 40,000 centipoises are handled at medium pressures. One of its chief advantages is that the standard design may be varied to individual service conditions. The materials of construction and the drive may be specified by the customer; plungers may be equipped with packing, cups or "O" rings; a ceramic or special alloys may be used instead of the standard stellite valve trim; flanged or sanitary connections may be employed, and higher pressures can be accommodated at reduced displacements.

The three single acting cylinders are available with bores of 1½", 2", 2⅜" or 2¾". The stroke is 2¾". Maximum capacities range from 10 to 30 gpm and maximum pressures from 450 to 1500 psig. Maximum recommended speed is 150 rpm.

DuPont Readies Nonflammable Solvent

Nonflammable solvents that will bite into and remove oil, grease, and dirt without harming delicate metal parts or electrical insulation, yet are safe enough to use in ordinary work areas with conventional ventilating equipment, are now available to solve a wide range of special industrial cleaning problems.

Adaptable to vapor degreasing or cleaning by liquid immersion, the solvents will be marketed by the DuPont company under its "Freon" trademark. Three types, all classified technically as "selective solvents," are available in container sizes ranging from ten to 55 gallons.

Big advantage of the "Freon" solvents, the company's "Kinetic" Chemicals division says, rests in their safety, both from a personnel exposure and material standpoint. Because they are nonflammable and nonexplosive, they can be used in open shop areas without danger of fire. In addition, from an inhalation toxicity standpoint, they are rated as the safest of the commonly used nonflammable solvents when used in properly designed equipment which minimizes vapor losses.

Electric Motors Greatest Aim

Most important use proved to date, the company said, is in cleaning of electrical motors, both new and reconditioned. Biggest problem there in the past has been the tendency of cleaning solvents to attack insulation on the motor wiring, weakening or removing it sufficiently to cause short-circuits when the motor is placed in operation. Three years of tests indicate that the "Freon" solvents will not soften, craze or dissolve any of the commonly used wiring insulation materials.

Other important uses developed for the "Freon" solvents, and

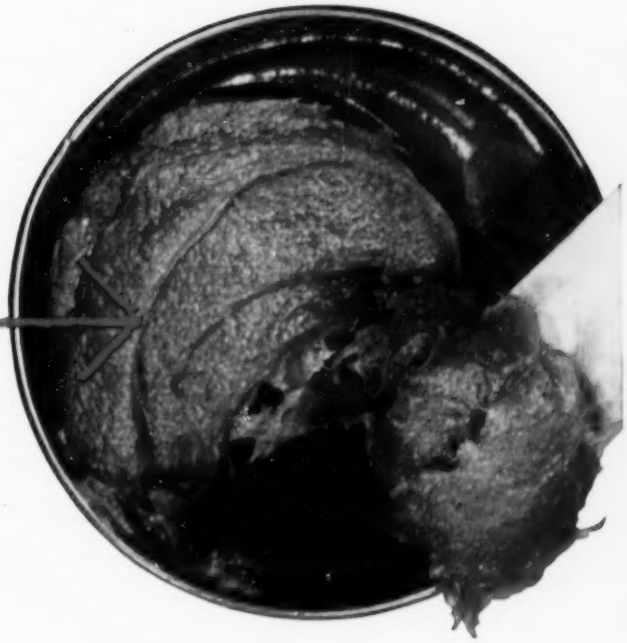
when you start with...

you have a fatty acid . . .
. . . made from marine oils
. . . 95.7% saturated
. . . containing no polyunsaturated acids
. . . composed largely of long chain (C_{20} and C_{22}) acids
. . . resistant to oxidation
. . . ideal for lime and soda based greases

SPECIFICATIONS

Titre	51 to 53°C
Acid Number	197 to 202
Iodine Value	6 maximum
Saponification Value	198 to 203
Average Molecular Weight	279 to 283
Specific Gravity	0.832
Color 5 ¼" Lovibond	Max. 25Y/2.5R

you end with a...
QUALITY GREASE



. . . a lubricating grease with superb workability.
. . . a grease that resists "bleeding".
. . . a grease that does not separate into soap and oil.
. . . a grease with excellent gel stability.
. . . a grease with water resistance.
. . . a uniform grease.

Hydrofol PRODUCTS

Hydrogenated and Distilled Fatty Acids and Stearic Acid . . . Hydrogenated Vegetable, Fish, Sperm Oil and Tallow . . . Hydrogenated Castor Oil . . . Stearyl, Cetyl, Oleyl Alcohol . . . Sperm Oils and Spermaceti . . . Behenic Acid . . . Erucic Acid . . . Hydroxy-stearic Acid . . . Olefins . . . Hydrocarbons.

Chemifats that put SELL into your products

WRITE FOR MORE INFORMATION

Gentlemen: Please send technical information on Hydrofol Acids 51 and other related Fatty Acids for the grease industry. Samples are available.

Name _____
Title _____
Company _____
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CHEMICAL PRODUCTS DIVISION
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proved in field applications, include cleaning of electronic instruments, photographic and sound recording films and tapes, oxygen breathing apparatus, and typewriter rollers. The "Freon" solvents also have proved useful as general laboratory equipment cleaners and as safe, efficient heat transfer agents in place of flammable and explosive acetone in low-temperature laboratory chill baths.

Another potential use of the "Freon" solvents is as an additive to other, more dangerous, solvents to decrease the latter's flammability, or change their solvency or boiling point properties for special applications. In such cases, it is important that the solvent mixture be formulated carefully so that the flammability of the mixture will be reduced to a safe level under all normal operating conditions.

Three types of the DuPont solvents now are available—"Freon" MF, with a boiling point of 75° F.; "Freon" BF, which boils at 199° F., and "Freon" TF, whose boiling point is 118° F. That range, the company explained, makes the "Freon" solvents adaptable to use in many types of mechanical cleaning equipment. Small, portable, and inexpensive cleaning tanks, which would not be suitable from a safety standpoint for use with more toxic or flammable solvents, are now being developed to make the "Freon" solvents easy to use in small-scale cleaning operations.

3-Million-Volt Electron Beam Probes Scientific Mysteries

A new research tool that probes scientific mysteries with a 3,000,000-volt beam of atomic particles traveling at nearly the speed of light was demonstrated recently by Shell Development company.

The machine is a Van de Graaff accelerator. It is the most powerful radiation source in industry. Depending on how it is used, it is up to 50 times more powerful than the largest cobalt-60 source in industry.

The new unit accelerates electrons to a speed of 184,400 miles per second—so near the speed of light that their effective mass is multiplied sevenfold. They thus become a new and powerful source of energy for research and processing.

More About Molecules

Dr. Harold Gershinowitz, president of Shell Development, said a specially trained group of scientists in the firm's 1500-man laboratory will use the electron beam as a super probe in learning more about what goes on between molecules—and inside molecules—during certain processes.

A chief advantage of the machine is that it speeds research. Its high energy beam permits scientists to make in minutes or hours a number of studies that would take so long with other radiation sources as to be out of the question.

The accelerator will also aid in developing fuels and lubricants for the atomic age, Dr. Gershinowitz said. It generates the same kind of radiation as that given off by atomic reactors and thus permits research on the behavior of petroleum products under the operating conditions that will prevail in atomic power plants.

The machine produces the active molecular "fragments" that are essential in chemical reactions but have so far been hard to study because they exist for so short a time. With the new machine, scientists can produce the fragments of sub-zero temperatures and keep them in crystalline lattices, which serve as deep freezes, for study at leisure.

Energy produced by the accel-

erator will change a liquid chemical to a solid plastic, vulcanize rubber, perhaps even create entirely new products.

Dr. Gershinowitz said the machine may lead to new methods of chemical manufacture because of the new type of energy it provides—easier to apply than ultraviolet light and in many cases more selective than heat, the traditional energy source.

South Penn and Pennzoil Move to Drake Building

South Penn Oil Company and its Pennzoil Division have moved to new headquarters in the Drake building, Oil City, Pennsylvania. George J. Hanks, South Penn president and chairman of the building committee said the renovation of the building, located at 106 Duncomb Street had been under way for over a year, and that sixty-seven attractive offices were now completed.

South Penn was incorporated in 1889 and its active drilling program has included the acquisition of such properties as the Devonian Oil company, Matson Oil company, Producers Consolidated Land and Petroleum company, Midland Oil company, Union Oil company, Forest Oil company and others.

In 1911, the shares of South Penn were distributed to Standard Oil company (New Jersey) stockholders, and as a result, South Penn has been a completely independent company for over forty-five years. In 1926 fifty-one per cent interest in the Pennzoil company was acquired and a merger into South Penn was completed in 1955.

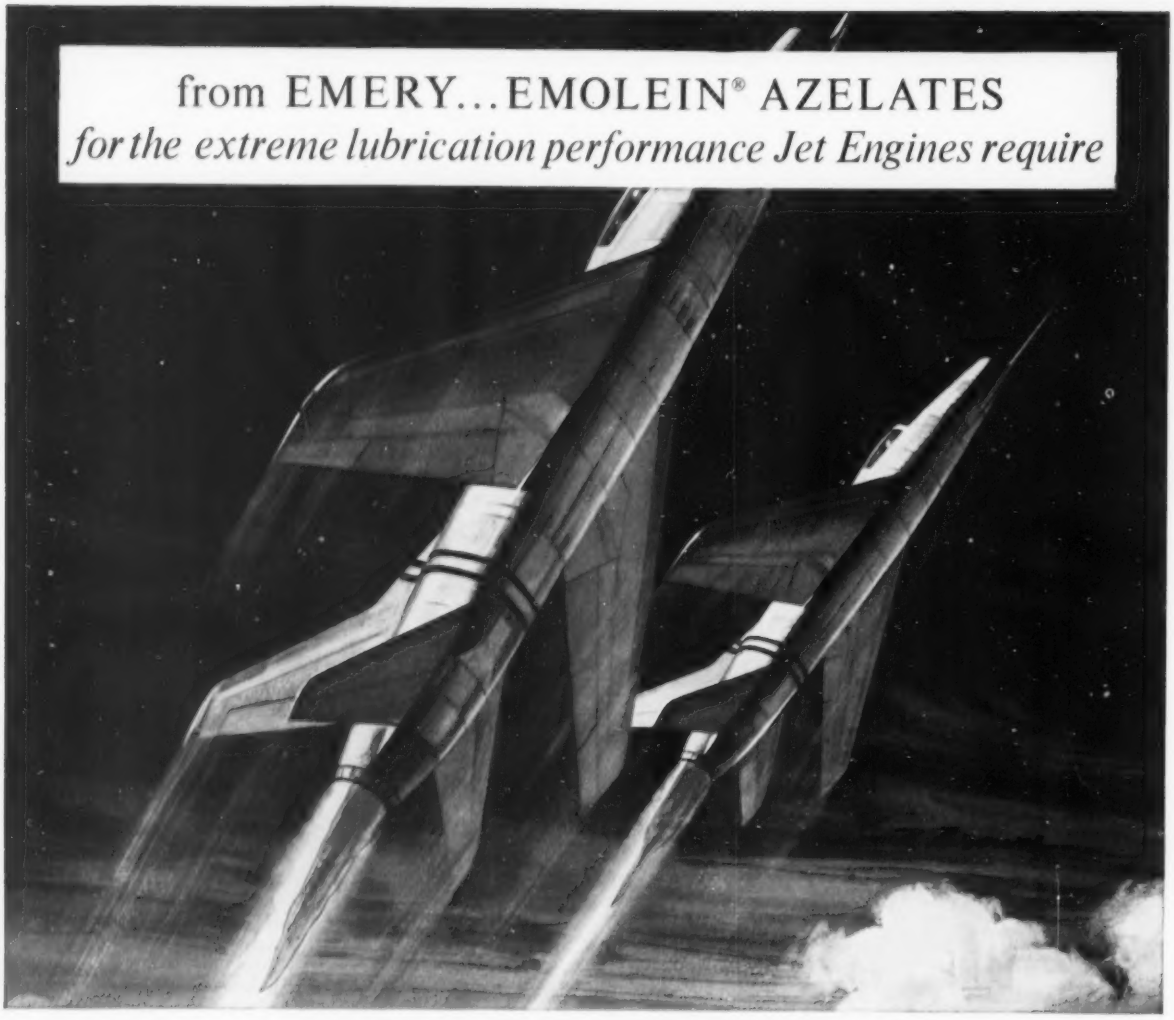
Charles L. Suhr, chairman of the board of directors of South Penn, began work with the Penn Refining company in 1892, in what is now plant number two of the Pennzoil division. When the Pennzoil company was formally established in 1921 he was made its president, and became chairman of the board in 1935. Suhr is chairman of the board of the First Seneca Bank & Trust company of Oil City, and an honorary trustee of the National Petroleum Association of Washington, D. C., of which he served as president from 1933 to 1939. Suhr helped organize the Pennsylvania Crude Oil Association of Oil City in 1923 and has served as a director since. He is also a director of the American Petroleum Institute and the British American Oil Company, Ltd.

Other officers of the South Penn company are: George J. Hanks, president and chief executive officer; John E. Selden, senior vice president and counsel; J. H. Young, secretary and controller; E. W. Kartlick, treasurer.

Check-Chart Issues Booklet Lubricant Service Points

Spot-check information on 1957 model passenger cars, illustrating

from EMERY...EMOLEIN® AZELATES
for the extreme lubrication performance Jet Engines require



MEETS BOTH MILITARY AND CIVILIAN REQUIREMENTS

Synthetic lubricant fluids that meet both military (Mil-L-7808-C) and civilian specifications are now being compounded from Emolein Azelates (diesters).

The excellent performance of these new diesters, Emolein 2957 di-iso-octyl azelate and 2958 di-2-ethylhexyl azelate in lubricants designed to meet the extreme heat and cold performance qualities required by jet engines, is attributed to the following combination of properties:

1) excellent temperature-viscosity performance even at high and low temperature extremes... 2) high viscosity index... 3) low pour points... 4) excellent lubricity... 5) oxidation and corrosion stability... 6) high flash and fire points... 7) excellent additive response.

Produced from non-strategic raw materials

Since the Emolein azelates are based on azelaic acid obtained from domestic fats and oils abundant in supply, availability is not contingent on strategic imported raw materials. Also, future plant expansion is being carefully coordinated with the broadening utility of these diesters.

Application in other synthetic lubricants

Other military specifications met by synthetic fluids and greases compounded from Emolein Azelates include: Mil-G-3278 A, Grease, Aircraft and Instruments-Low and High Temperatures; Mil-L-6085 A, Lubricating Oil, Aircraft Instruments, Low Volatility; and Mil-L-6387 A, Lubricating Oil, Synthetic Base.

Mail coupon below for full technical information.

Emery **Organic Chemical Sales Department**

Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio

Emery Industries, Inc., Dept. E-2 Carew Tower Cincinnati 2, Ohio

Please send me a copy of your 16-page Technical Bulletin No. 409 titled "Emolein Esters for Synthetic Lubricants."

Name.....Title.....

Company.....

Address.....

City.....State.....

main service locations and listing basic lubricant recommendations, has been published under the title 1957 Service Data by the Check-Chart corporation.

As an introduction to correct new car maintenance, the publication is of especial value to service station personnel. For this group of automotive men, particularly, there is a pictorial section outlining accurate and rapid pump island service procedures.

Copies may be obtained from Check-Chart corporation, Sales Department, 33 East Congress Parkway, Chicago 5, Ill. Single copy price is fifty cents.

API-NLGI Oblong Can Standards Published By ASA

In March, 1951, a proposed American Standard for five-quart and one-gallon round cans was submitted for ASA approval by the joint container committee of the American Petroleum Institute and the National Lubricating Grease Institute.

On March 24, 1951, a general conference was held at ASA headquarters to discuss the development of an American Standard for motor oil cans. The conference recommended that dimensional standards for one-quart, five-quart, and one-gallon motor oil cans be established, and a drafting committee was appointed to prepare a draft proposal, which resulted in the approval of the American Standard specification for one-quart round motor oil cans, B64.1-1954.

In September, 1953, the joint container committee (API-NLGI) submitted three additional proposals for approval as American Standards. These proposals were referred to the members of the general conference for review, and received unanimous approval by letter ballot vote of the members.

These three standards were approved as American Standards on August 4, 1954, and designated: Requirements for five-quart and one-gallon round cans, B64.2-1954; Requirements for oblong oil cans, B64.3-1954; and requirements for grease cans, B64.4-1954.

The organizations which participated in this work and the names of their representatives, as listed at the time this standard was submitted to the General Conference for approval, are as follows:

Joint Container Committee (American Petroleum Institute, National Lubricating Grease Institute) —Chester R. Reed, The Texas Company; R. Cubicciotti, L. Sonneborn Sons, Inc.

National Bureau of Standards, U. S. Department of Commerce—John C. Hughes, National Bureau of Standards.

Packaging Institute—L. V. Burton, Packaging Institute; A. R. Dismukes, Gulf Oil Corporation; F. N. Landon, Sun Oil Company.

U. S. Department of the Navy, Bureau of Supplies and Accounts —John C. Wilford, Bureau of Supplies and Accounts.

Chester R. Reed, Chairman

Cartridge Loader Grease Gun Announced

The E-Z Cartridge Loader Grease Gun is capable of developing up to 8,000 pounds of pressure and accommodating any cartridge, according to the manufacturers . . . K-P Manufacturing company.

Leakage is prevented by a specially designed plunger which assures maximum sealing and the spring is tapered for easy nesting and constructed with high tension for top efficiency.

An eliptical-shaped lip smooths out dented cartridge ends by an easy twist of the cartridge when loading. Bulk grease may be used by leaving an empty cartridge in the barrel and loading the cartridge in the same manner as a conventional gun.

K-P Manufacturing company is located at 1226 Linden Avenue, Minneapolis 3, Minnesota.

SW's High Efficiency Grease Kettle

This 200 hp Struthers Wells Grease Kettle, shown being checked out at the SW Plant, represents a new design principle which permits heavy horsepower input, counter-rotating de-stratifying arms for "double motion" efficiency, plus hinged scraper blades for ultimate heat transfer. For greater production efficiency for all types of greases, let us design an SW *Double Motion* Kettle to your requirements.

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Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters

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MACHINERY for Sheet and Structural Metal Forming . . . Tangent Benders . . . Folding Machines . . . Roller Table and Tumble Die Bending Machines . . . Press Brakes . . . Punching and Notching Machines . . . Forming Dies

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Plants at Warren, Pa. and Titusville, Pa.

Offices in Principal Cities

big interests . . . [illegible] tion has performed that function well . . . The Republican Party is not a fit instrument to govern a Nation that wants to make progress for the benefit of the ordinary people."

VISITS SIX COUNTIES

Stevenson earlier had a word about Mr. Eisenhower's personal role in governing the Nation. At [illegible] setts for three days, next week he heads west to Washington and California.

The Democratic nominee told his Jersey City audience that President Eisenhower must personally take the blame for "the shortcomings in the public housing program."

He said Mr. Eisenhower's reac- Stevenson said.

Specifically he accused the Republicans of using their "liberation" policy vis-a-vis European satellite countries for political purposes.

At the eight cities the Democratic Presidential nominee visited, he welcomed the local and Con-

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All the rest of it is in the mind of the lucky ones who see the picture, which is just another way of saying that originally the thought and the whole idea were in the mind of the photographer. Accidents can and do happen, but if your picture expresses something worthwhile and makes the observer think as he sees it, the chances are many millions to one that the photographer had an idea and [illegible] used his photographic tech-

THE FALL COLOR MOVIE

Along about this time of year everybody who has a movie camera —and who has not?—goes out to make a movie of the wonderful artistry with which Jack Frost has painted the leaves.

Most unhappily, too many of those movies might better have been made with a still camera. Because of the techniques used, or perhaps the lack of them, the pictures made with the movie camera

even better if father or some other member of the family knows enough about the trees to discuss their differences in closeups that might show leaves or bark or anything else that seems to him, as a naturalist, to be important.

POINT OUT TREES

If the approach is to be entirely scenic, remember that scenes need life in them if there are going to be very many of them. Let somebody walk into the scene to show

Stevenson smiled and said "Speaking of Ike, I'd trust him

ON SCHOOL NEEDS

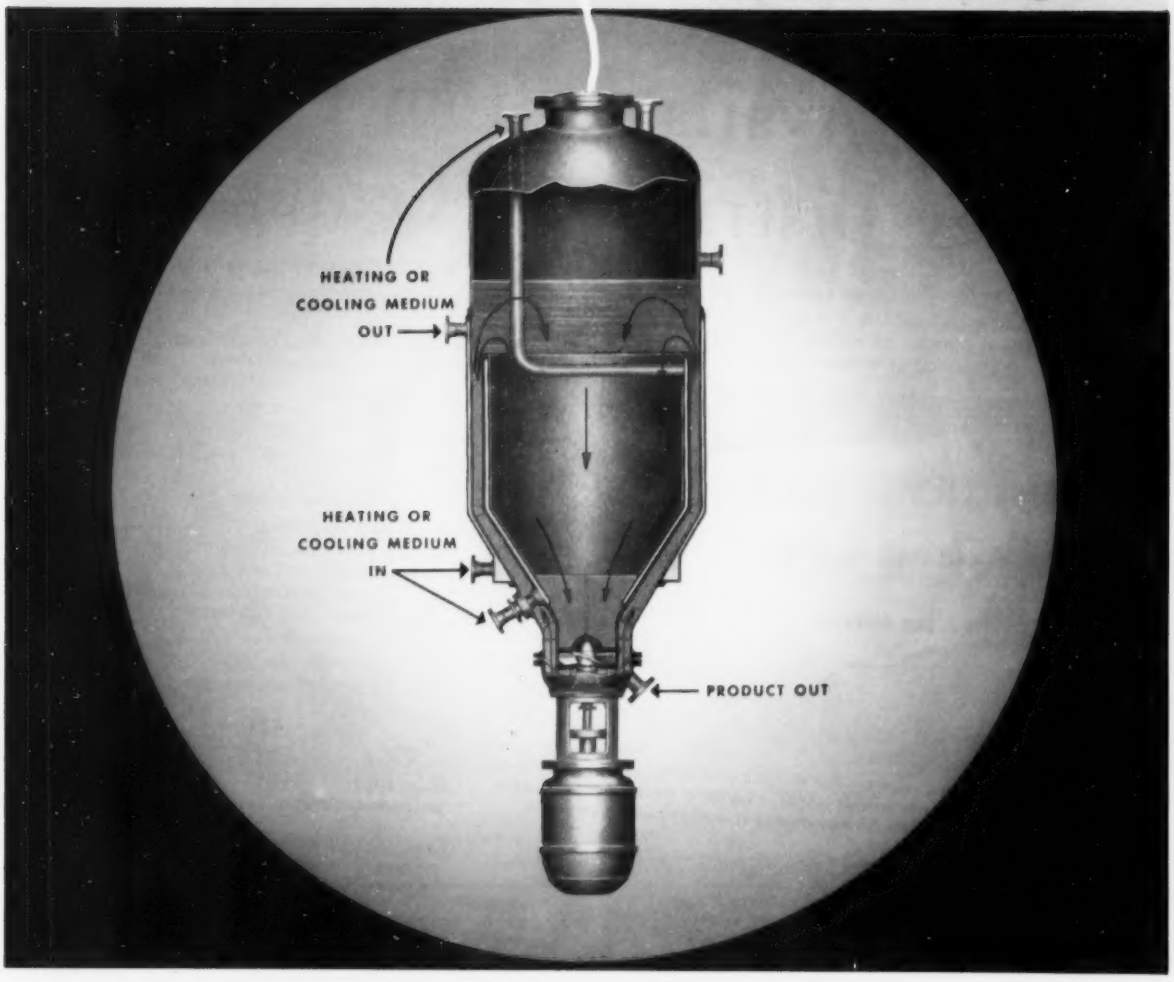
When it came to schools, Stev- [illegible] said Mr. Eisenhower as a

Ex-Dancer Dies in Leap

SAN FRANCISCO, Oct. 2 (AP). —A former dancer, apparently

The STRATCO contactor

Reg. U. S. Pat. Off.



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Adaptable to existing plants to improve quality of product and reduce manufacturing cost. A vital part of all complete grease plant installations.

Used for complete saponification of all soaps with very short time cycles, resulting in less soap requirement, simplified laboratory control and reduced man hours of operation. Also employed advantageously for sulphurization of oils. Available in capacities from 2 gallon laboratory units to 2300 gallon commercial sizes.

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